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Donald A. Schon on Effecting Technological Change

Edward E. David, Jr.: Toward New Initiatives
Charles O. Miller: Why "System Safety"?
Leonard Bertin: Science Policy in Canada
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Technology Review

PROGRAMS OF SOCIAL AND TECHNOLOGICAL CHANGE

AND PROGRAMS OF SOCIAL AND TECHNOLOGICAL CHANGE

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The First Line

A special commission of M.I.T. faculty, surveying one institution's opportunities for more effectively educating scientists and engineers to deal with a new generation of socially oriented problems, has called attention to the difficulty of maintaining faculty commitment to undergraduate education: there seems to be "a shift of teacher loyalties away from undergraduate general education toward . . . graduate and undergraduate special education and . . . to the profession, where the scholar can hope to achieve the widest peer-group recognition," complains the M.I.T. Commission on M.I.T. Education.

In this way has been raised once again the ancient argument about "publish or perish," the question of how a teacher's priorities should permit him to maintain his professional effectiveness and at the same time fulfill the personal expectations of the traditional teacher.

There need be no argument.

For M.I.T., for example, the decision was first made when William Barton Rogers, in founding the Institute, proclaimed that there is dignity in useful knowledge. "There is no branch of practical industry, whether in the arts of construction, manufacture, or agriculture, which is not capable of being better practiced, and even of being improved in its processes, through the knowledge of its connections with the physical truths and laws . . ."

Any analysis of M.I.T.'s greatness in the 1920's, when the Institute was struggling to change from "Boston Tech" to a cosmopolitan school of engineering and science, must have sensed Dr. Rogers' wisdom. In those days, when industrial commitments were the exception for engineering educators, M.I.T. by policy made it possible for faculty to spend up to 20 per cent of their time in professional consulting and non-Institute research. The policy continues to this day.

In the post-World-War-II era, when the U.S. was first converting campus research from wartime to peace-time—and then, too soon, reconverting some of it to "cold war" needs—the dialogue began again: how often should a faculty member's secretary have to report that he was "out of town" for the day, or the week?

But one may now extend the argument. As we reach for a better understanding with young people, and as technology continues to depend increasingly on techniques—computation, for example—which young people understand at least as well as the best of their teachers, there may be a better way. Let students and their teachers work together on the problems which can keep them both on the cutting edge of their professions. Let the teacher and his students be "out of town" together—in Washington, Oak Ridge, Anaheim, or Shiprock.

The first stage is to give up the image of "Mr. Chips," the deeply human scholar who literally devotes his life to his students; he simply cannot understand his world as an engineer must.

The next stage is to give up the image of the engineering educator rushing from his consultations in Pittsburgh to conduct his class and then to retire to his electron microscope. His lectures and quizzes are good for theory but not for practice.

Our goal now can be a new wholeness —of teaching, research, and practice; of students, teachers, and those whom they propose to serve.—J.M.

Next Month

"Research, Technical Progress, and Economic Growth," the provocative analysis of the (dis)connection between economic growth and research investment by Lester C. Thurow, Professor of Economics at M.I.T., was originally announced for the February issue of *Technology Review*. It will instead appear in March—an editorial decision not revealing any default by the author.

"Ultimate Disposal of Industrial Wastes," by Robert B. Dean, Chief of the Federal Water Quality Administration's Ultimate Disposal Research Program: When is a waste a product, and what can we do to change our answers to that question for tomorrow?

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for
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Cambridge Journal

Or, for that matter, is Los Angeles? Or Chicago? Or Philadelphia? Or Dallas?

Or any other city groping its way to an uninhabitable anachronism.

A curious situation has developed in America. Eighty per cent of the people in this country live on less than ten per cent of the land area.

There used to be a good reason for this.

At the time of the industrial revolution, we congregated in cities because that's where the sources of energy were. Coal. Water. Electricity.

And our communications network was so limited that we had to be in close proximity to each other for business and social purposes.

No more.

There are no longer any good reasons to continue this hopelessly outmoded life style.

With the advent of the whole spectrum of new communications available to us (wide-band communications, laser beams), we will have the opportunity to live in significantly less dense population centers.

This is no idle prophecy.

The concept is quite realistic and well within the bounds of engineering capabilities which we already have.

Not only do we have the tools to provide the means for new styles in human settlements, but also to rebuild, in a sociological sense, the crowded inner core of our major cities.

The combination of international satellites and cable will provide the means of bringing individuals all the information they need or want without interference or control.

And without the need to be in any specific place.

(Think for a moment about the Apollo 11 moon landing in July, 1969. 500 million people around the world saw, via television, *precisely the same thing at the same time.* Being in New York or Los Angeles held no advantage over being in Keokuk or Harrisburg.)

Historically, we've been preoccupied with moving people and objects. Thus, our intricate network of highways and railroads and airlines — all of which have become enormously inefficient (not inherently, but in application).

The future will see us moving *information,* not, by necessity, people and things.

Your home will be the absolute center of your life.

You will work from home, shop from home, "visit" with family and friends from home, receive in your home any intellectual or cultural achievement known to man.

Fantastic, yes. Fantasy, no.

It is quite within reason to expect these changes by the 1980's.

If we want them.

If we want to change. If we want a better life for ourselves.

Technology has advanced to such an extent, that man is now, literally, capable of changing his world.

Yet, today, a certain gap has developed between the potential of technology and its use by mankind.

There is an obvious contradiction in a method which can land a man on the moon, yet tolerates, perhaps even accepts as inevitable, poverty and ignorance here on earth.

There is a contradiction in a method which affords the best of everything for some, and next to nothing for others.

So we must, in a sense, catch up with the technological potential and apply it for the benefit of all mankind.

All we need sacrifice are the antiquated work practices and our anachronistic traditions.

At RCA, through research and product development, we are committed to closing the technology gap and cancelling the contradictions.

This is the age of the engineer. Nobody understands this better than RCA.

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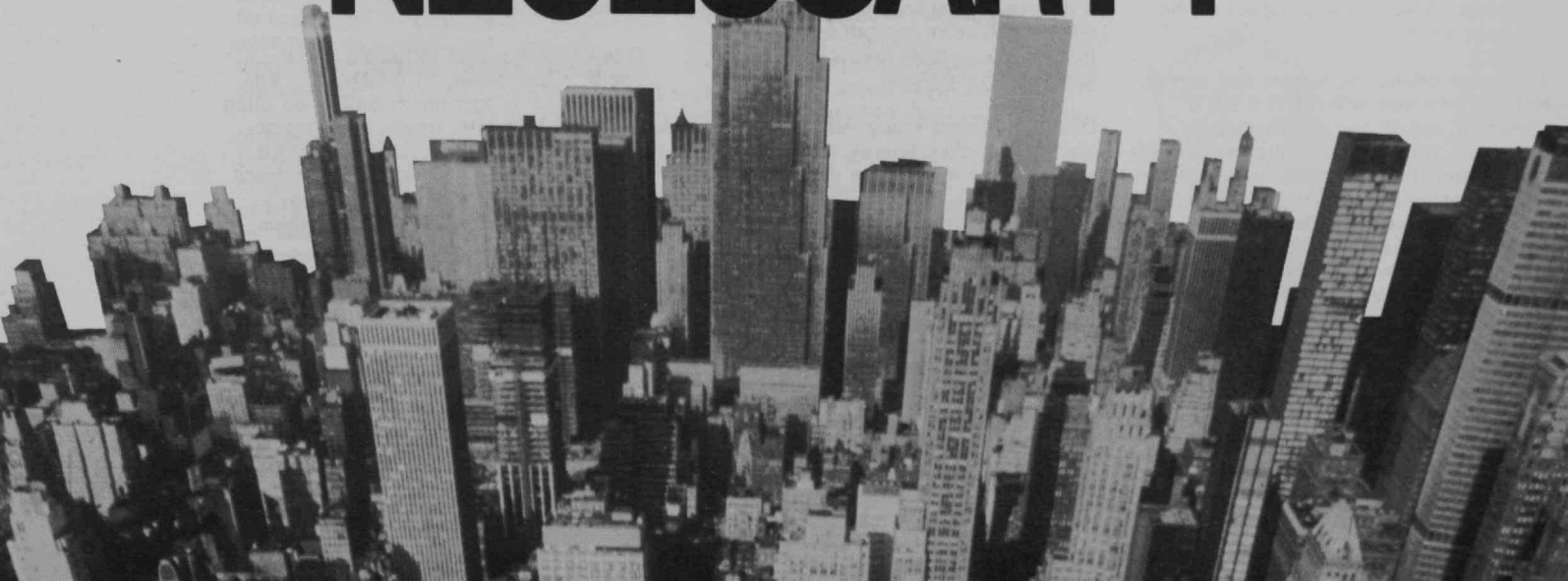
IS NEW YORK REALLY NECESSARY?



Science Review
Robert C. Cowen

Can a scientist truly seek a more responsible science without taking to himself an elitist power to judge his own—and his colleagues'—work? Perhaps, if he can be sure that those who seek to use his information truly understand its context and its limitations

How Elitist Must Responsible Science Be?

Assemble a group of "name" scientists. Get them to kick around the subject of "social responsibility" in a hot field like the new biology. And you've got a surefire, self-guiding system for finding your way back to square one.

That's the square with the motto: "Science has such impact on man it must be brought under firm social control—just make sure scientists do the controlling." For years, supposedly serious discussions have begun and ended on this elitist note.

It could all be rather discouraging but for a couple of saving graces. Many young scientists are having none of it. And even some establishment types are beginning to question its supposedly self-evident wisdom.

So when eminent American and European biologists went around the circuit from square one to square one in London recently, I came away feeling there may be a glimmer of hope of coming to grips with the real issues after all. These are such issues as how to establish a truly socially conscious means of setting research priorities; and how to get more awareness of relevant scientific trends into the public decision process.

The year-and-a-half-old British Society for Social Responsibility in Science (B.S.S.R.S.) convened the conference to talk over "The Social Impact of Modern Biology." That's the monster with such hydraheads as genetic engineering, human embryo manipulation, and the somewhat more vague prospect of the test-tube baby.

To outline briefly the square one circuit, Nobelist Maurice Wilkins, B.S.S.R.S. President, led off the discussions by noting the widespread desire for controls on research that seems to hold threatening implications for mankind. Controls, he said, must come from within the scientific community. Otherwise, we could have an even worse situation than we're trying to avoid. "If we are afraid of science, let's not have an irrational reaction," he pleaded. Evidently, letting the public have more say in setting research goals would be an "irrational reaction."

Carrying this attitude to its extreme, Jacob Bronowski, philosopher-scientist from the Salk Institute, ended the conference by urging scientists to "disestablish" themselves. They should break their ties with government. By an undefined process of selling rights in their discoveries for royalty payments, they might finance their own work. Then scientists themselves would meet to set research priorities for the good of mankind and parcel out the funds, Dr. Bronowski suggested.

How elitist can you get? Can you imagine a group of the old boys setting priorities for the uptight social relativists coming into the labs these days? The Bronowski proposal at least has the virtue of being so absurdly impractical as to effectively burlesque the elitist syndrome.

Even urbane and perceptive Jacques Monod, Nobelist from the Pasteur Institute, had a tinge of such elitism in his views. He asked what scientists should do if they discovered something with such horrendous implications that the knowledge might be better suppressed.

As a hypothetical example he mentioned discovery of a truly effective way of measuring intelligence differences between groups or races of people. In today's racially sensitive world, this could be social dynamite.

In such a case, he suggested that the scientist call in trusted colleagues. Together they would decide whether to publish or suppress the discovery. And, if it were published, they might decide to release the news in such cryptic form that no one outside their circle would grasp its implications.

Does Dr. Monod really think scientists are such godlike figures that they can or should try to manipulate the fate of the world? I don't think so. The whole thrust of his comments throughout the meeting reflected a sense of humility in the old Christian sense of the word. So did Maurice Wilkins' general remarks. Therefore, some of us asked him at a press conference how he squared his apparent elitism with what seemed a desire to make science a socially responsible part of world culture.

What Role for the Establishment?

He said he's painfully aware of the elitism trap. But what to do to avoid thought habits of a lifetime? Of course, he's elitist. Science is an elitist activity. Can he help it if he's a Nobel prize winner who doesn't rub elbows with the trash collector? What he sees to do is to press on with meetings like the one then in progress, trying to involve laymen in the discussions. Then perhaps the elitism will begin to decay. Here, at least, is a healthy awareness of one of the biggest hang-ups scientists have in developing socially responsible science.

Certainly Dr. Wilkins is aware of pressure from young scientists on this point. Both at this meeting and even more loudly at a session of the B.S.S.R.S. during last summer's British Association for the Advancement of Science gathering, they complained about the system that put the establishment in charge even of social discussions. And many of them keep protesting that scientists have no moral right and certainly no superior wisdom to justify claiming primacy in setting the research priorities for a nation's scientific effort.

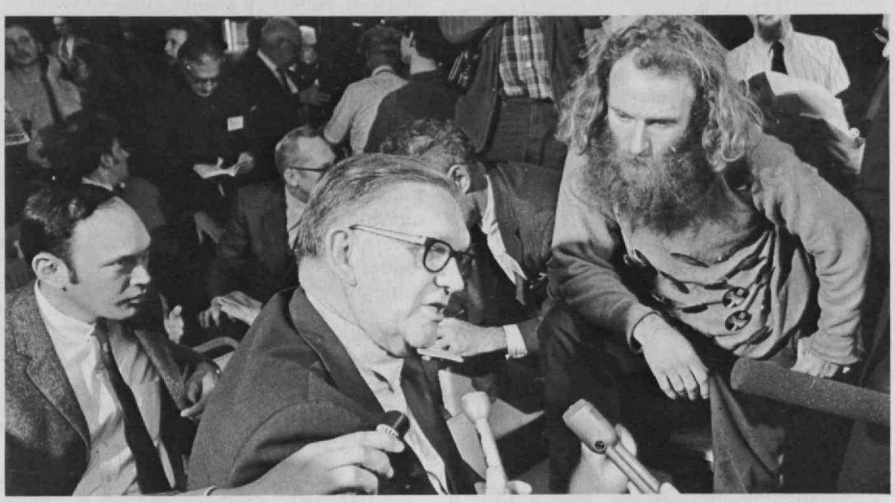
The biologists' meeting got down to more earthy aspects of responsibility when R. G. Edwards of Cambridge University and G. H. Beale of Edinburgh University talked about some of the social impact genetics has right now. Dr. Edwards has made headlines in the past year in connection with "test-tube" fertilization and initial development of human eggs destined for implantation in human mothers.

One of the troubles of talking about social responsibility in biology, Dr. Edwards said, is that the scientists so often deal with long-term trends and abstractions. They should get down to what it means to people—individual experimentation, abortion, and other emotion-charged scientist-people relationships such as he has to deal with.

The Scientist: Where the Buck Stops

What constitutes responsibility in these personally crucial matters? As far as he is concerned, he said, the buck stops with the individual scientist and patient in such experiments as he undertakes.

Science for the People may be America's nearest—but much more political, less intellectual—counterpart of the British Society for Social Responsibility in Science. At the end of its activities during the 1970 meeting of the American Association for the Advancement of Science, Science for the People claimed that its "pervasive climate of social and political discussion and inquiry . . . has improved (the quality of this convention) immeasurably. . . . Military murder, government manipulation, and corporate profit-making run counter to the way in which (a large number of scientific workers) would like to see the products of their work applied." Here Jonathan Jackson listens to Representative Charles A. Moser of Ohio. (Photo: Wide World)



There's no question of a consensus morality among scientists here. It is, in his judgment, absolutely imperative that he himself make sure that the patient understands the implications of the experiment. Then, as free from pressure as is possible, the patient decides whether or not to go along with the research.

Scientists may talk in airy generalities about needing new moral guidance at such meetings as this. But, Dr. Edwards said, there is no escaping individual responsibility in getting down to his kind of work. And if you don't have a sense of personal integrity about it now, at this stage of the development of the new biology, discussions of social responsibility will lead nowhere. Perhaps, he suggested, it would help to get more such men as himself, men engaged directly with people, into the B.S.S.R.S. discussions.

In this vein too, you don't have to appeal to hypothetical cases, as did Dr. Monod, to raise the question of ethical release of knowledge. Both Dr. Edward and Dr. Beale used the example of the "criminal" chromosome set to illustrate this. This is the XYY set (an extra component in the XY male sex chromosome set) which a small percentage of men carry. Statistical studies in some penal institutions showed what seemed an abnormally high incidence of XYY's among inmates. The hasty conclusion that this abnormal chromosome set somehow tends to give possessors a tendency toward aggressive criminality spread quickly. It was introduced in court cases as evidence of criminal insanity. Its presence in advanced fetuses has, in Britain at least, been used as reason for abortion, according to Dr. Edwards.

Both scientists said geneticists are embarrassed by all this. The conclusion about criminal tendencies was taken with no knowledge of how such a chromosome set expresses itself in people. It was taken with no knowledge of the frequency of XYY's among the supposedly normal population. There are plenty of perfectly sound XYY's walking around today, Dr. Edwards observed.

The Consequences of Publication

How then can scientists in future prevent such a wild conclusion based on limited research from being acted on socially? Dr. Beale suggested that the scientists directly concerned are themselves at fault. Scientists have too much of a tendency to publish their results without a thought of social consequences, especially of consequences due to misinterpretations. Scientists must, he said, develop an awareness of this. They must learn when and how to report socially sensitive findings in ways that will help avoid the XYY fiasco. This is different from Dr. Monod's suggestion of scientists quietly suppressing "dangerous" knowledge. It calls for a public relations awareness in the more modest workaday scientific projects. This may not seem quite so transcendently glamorous as a research for a new morality for biologists. But Dr. Beale noted, as a practical matter it could be crucial in bringing some of the potentially harmful impact of new knowledge under more responsible social control.

Dr. Beale and Dr. Edwards may be on to something here. Developing a greater degree of social responsibility may indeed depend more on what scientists do in such workaday situations than on their periodic think sessions in special meetings. Perhaps too, coming up against the nitty-gritty kind of decisions will erode that obstructive elitism that seems to hamper their thinking in such meetings.

The scientists are struggling with tough questions. They are, at least within the traditions of research, without much precedent to help them. So the very fact that some of the greatest among them are humbly willing to make the effort to break through old thought patterns is encouraging. Dr. Mondo put it this way in explaining why he stayed to the end of the London meeting, far longer than he had planned. "I am a very busy man," he said. "I am invited to many meetings and have to turn many of them down. But I think these issues are so important that working with them interests me more even than a meeting devoted to the subjects of my immediate research."

Robert C. Cowen, who studied meteorology at M.I.T., is stationed in London as Science Editor of the Christian Science Monitor. *His "Science Review" is a monthly feature of* Technology Review.

Washington Report
Victor Cohn

Washington's science leadership now has a "shopping list" of priority needs. Whether it can be fulfilled, and when, depends on money and will power. Does Mr. Nixon really believe in science?

Science in the Begabuck Era

Science in Washington is a fallen Camelot, looking for a new Arthur, or, gadzooks, a Merlin. Alas, there is none. The money is tight, and there is neither Merlin nor Moses to lead science out of the wilderness, only men.

And only men who have been found "disappointing" by assorted critics.

Dr. Edward David, from Bell Laboratories, engineer, unknown, now heads the President's Office of Science and Technology and is President Nixon's chief science adviser. Because he was not established, because he could not automatically "speak for science" like a celebrated Kistiakowsky or DuBridge, David, whatever his worth, was greeted unenthusiastically by scientists and the scientific press.

Dr. Philip Handler, an anointed establishmentarian, heads the National Academy of Sciences. Under him, we were told, the Academy was to seek a more effective dialogue with government. If such a dialogue exists in any effective way, it is a well-kept secret. The Academy's reports have been voluminous, its influence thin.

Dr. William McElroy, biologist, Director of the National Science Foundation, speaks plainly and effectively to Congressmen and—with strong help in this matter from Lee DuBridge, David's predecessor—succeeded in winning the first appropriation of more than $500,000 to fuel what may prove to be a new and more vibrant N.S.F. But in part he had to do it by starting to turn this one "basic science" agency into still another applying itself to the "relevant." A few critics see this as an unwise retreat.

McElroy, of course, doesn't see it that way. None of these men in fact is a rummy, and some may yet be judged brilliant when a little more time has passed. Still, none is Merlin, and they are the first to assert it.

In the absence of Moses or Merlin, a country—if it would remain a leading scientific and technological country—must seek a right course painstakingly, rather than by sheer, unlimited spending or genius. It must, in a phrase heard constantly in Washington in recent months, seek a "science policy."

"No," we had "no" science policy and we needed none as long as the megabucks were available, Dr. DuBridge conceded to the House Science Subcommittee last summer. But today things are different. Only begabucks are to be had.

Trouble in the University-Science Axis

Science and the colleges are both in trouble. True, the colleges have been shoring up research and graduate education with remarkable success, considering their sharply reduced federal support measured in constant dollars. But they have done so to a large extent by spending reserves and eliminating so-called frills. These frills are likely to be urban affairs or earthquake institutes or summer theaters or even black studies programs, yesterday's darlings. One man's frill may be the heart of another man's education.

The effects as of today (rather than those of a year ago, in lagging reports) are just beginning to be measured. Johns Hopkins University says it will trim its faculty next fall by 10 per cent. The Wisconsin legislature has cut $5.3 million from its university's budget—for economy, and for pique at the radical left. Many schools are reducing social science programs, often feebly funded to start with. Many are cutting back on scholarships for minorities and the poor.

Plainly a broad "higher-education/graduate education/national-research" policy rather than just a "science" policy is the need. And plainly no one at the moment is going to be able to draw an Excalibur and carve out an effective new program in this image. More national income; a greater "public needs budget" as part of that elusive reordering of priorities that our social reformers dream about; probably some sort of new super-Sputnik to jolt us—all may be needed.

No early solutions are likely to be reached by an administration and Congress who have been more at odds month by month, and are likely to be more at odds still as the 1972 election approaches, with a growing pack of Democratic candidates in Congress now sometimes more eager for personal credits than self-effacing solutions.

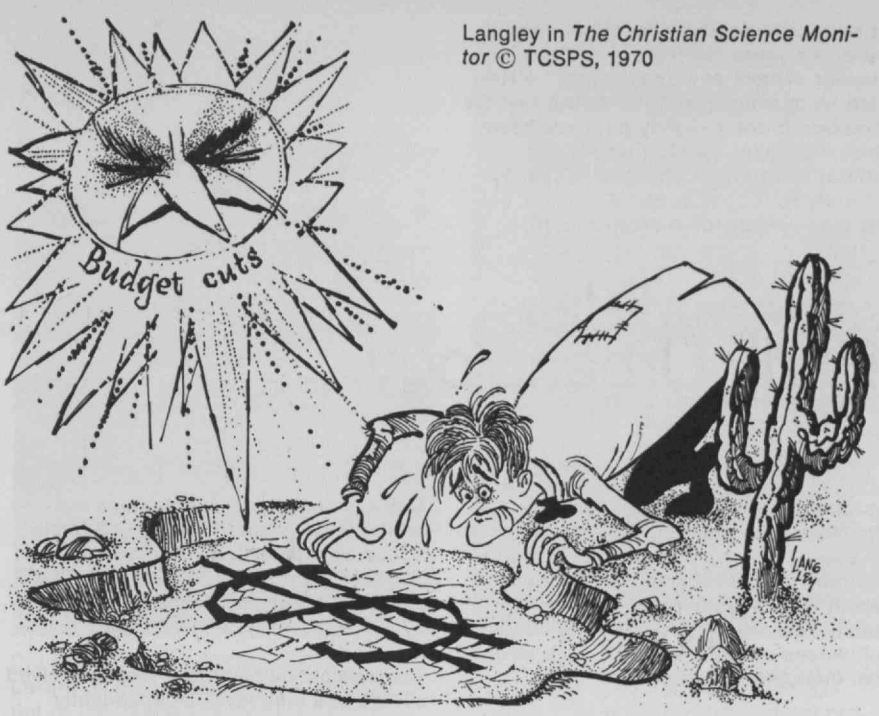
Five Items on the "Shopping List"

Still, out of all the recent "science policy" and "educational crisis" discussion some possible guidelines are emerging. Much of Washington's science leadership would now agree on something like the following shopping list:

1. A federal higher education policy to give colleges and universities some sizable "bloc" or "formula" grants, hopefully at a steady level of funding. What is wanted is money that colleges can spend more as they please, to let them choose some of their own research and educational goals—not just apply to Washington to solve this year's Big Problem.

2. Some new method and large new scale of financial support for students to counter the present trend of reduced graduate training support and the Nixon administration's emphasis on loans instead of fellowship "gifts." Dr. Handler last summer said "the time has come for American society to underwrite the education" of all graduate students—with a "National Youth Service Program" to do it, collecting by way of payment three to five years of national service rather than cash payments on loans. The Carnegie Commission on Higher Education recently argued for something like a "civilian G.I. bill" to subsidize students with low incomes. Here, as in general aid to higher education, most administration proposals clashed in the last Congress with opposition alternatives. Then both died in most cases for lack of funds or for lack of really strong interest on either side.

3. Some sensible streamlining, at the same time, in the universities. There is growing support, for example, for abandoning the concept of the costly research-oriented doctorate as everyone's Holy Grail and substituting a "Doctor of Arts" for students headed for many kinds of jobs. The N.S.F., the American Association of State Colleges and Universities (the smaller, non-land-



Langley in *The Christian Science Monitor* © TCSPS, 1970

grant schools), the Council of Graduate Schools, and the Carnegie Commission have all declared recently for some such experimentation. Carnegie-Mellon University is trying it.

4. More money, to be sure. There has been some talk of a formula (1 per cent of the G.N.P.?), but not much agreement on this goal. Everyone agrees that "more" is needed for both basic and mission research. Everyone recognizes that some researchers must go "where the money is," which is another way of saying where the need is, as Congress perceives it. McElroy's N.S.F. has started $13 million worth of I.R.R.P.O.S. (Interdisciplinary Research Relevant to the Problems of Our Society)—on problems like "environment and technology assessment"; "land use and energy flow component of a model of society"; and even "fire problems research" (at Johns Hopkins, as it happens, where Dr. McElroy, in a meaningless but nice coincidence, did research on the firefly). The problems of environment alone cry for more research spending. But also—almost every scientific leader agrees—the country will suffer if basic research then suffers. "Relevance," warns geneticist Joshua Lederberg, should only be carried so far. Who would have been wise enough in their day to fund Einstein or Pierre Curie or Harvey? It is currently faddish to deride scientists who are continually asking for "more" to fund their "pet projects." But overemphasis on application may restrict the country's future.

5. Some genuine steps to put unused and underused scientists and engineers to work on today's problems. The nation as of late 1970 was stuck with at least 45,000 unemployed and 45,000 underemployed in these valuable categories. It is now shortsightedly talking of "cutting technological training" at the same time that the Bureau of Labor Statistics and other agencies—looking at near-future population and college enrollment trends—fear a shortage of chemists, physicists, and some kinds of engineers as early as 1980. Dr. Wallace Brode of the American Chemical Society wants the government to put today's surplus science-power to attacking essential tasks in what might be called a kind of new "W.P.A.," implemented mainly through contracts and grants. So far this has been tried only on a small scale, mainly by giving aerospace companies contracts to assault urban and other societal problems. Most of these efforts have won poor marks.

A Scenario for Using Science

Many scientists and technologists still believe that interdisciplinary teams, properly led, could successfully attack many such problems, in the same way that physicists, chemists, mathematicians, biologists, and engineers in World War II joined to devise new ways to sink submarines—and in fact, opened a whole new era of operations analysis and "systems approach."

Most scientists are not high on turning today's problems over to the aerospace industry, as hard pressed as it may be. They feel it is already set in its own mold, a mold that is expensive in money and men. They see a need for new mechanisms, suited to the task.

As Dr. John Platt, a research biophysicist who is Associate Director of the University of Michigan Mental Health Research Institute, recently proposed in *Science*: "I think that nothing less than the application of the full intelligence of our society is likely to be adequate . . . I believe we are going to need large numbers of scientists forming something like research teams or task forces for social research and development . . . full-time interdisciplinary teams combining . . . natural scientists, social scientists, doctors, engineers, teachers, lawyers, and many others . . . who can put together our stores of knowledge and powerful new ideas into improved technical methods, organization designs or 'social inventions' that have a chance of being adopted. . . ."

So goes part of the current scenario for putting science and scientists to work. Even among those who agree on it, there is more pessimism than optimism right now about seeing much of it done.

Much of the problem is money. But much is also will. Much also may be men and organization. How adequate and how effectively involved *are* the President's science adviser and Office of Science and Technology; other federal officials; the Congress; the President himself? Does Mr. Nixon really believe in science?

Victor Cohn heads the science writing staff of the Washington Post; *he will receive the American Chemical Society's Grady Award for distinguished science reporting early next month. Mr. Cohn will continue his discussion of what he calls "Washington's present science disorganization" and what might be done about it in this space in* Technology Review *for March.*

In an archaeological site which "would rank as a large [one] even in the more nuclear centers of Mesopotamia," a Harvard team is uncovering evidence that the invention of the city may not have been such a singular event, after all. Did natural disasters or changes in climate—possibly leading to severe drying out of the land—really force urbanization?

A Revolution in Early Urbanology

The hot, dusty study of how men first came to live in cities has a special fascination for people who live in a time of such rapid change that the end of civilization seems always near. So we are delighted whenever an archaeologist, with shovel, whisk broom, meter stick, and camera, uncovers another "lost civilization" like the one buried in a cataract of volcanic ash at Pompeii. Particularly attractive are places like the Minoan sea king's palace near the village of Akrotiri on the Greek Island of Thera, uncovered in 1967 through the intuition of Professor Spyridon Marinatos, the Greek government's Chief of Antiquities.

But archaeology is more than a treasure-hunt for ancient life-patterns with an almost unexplainable fascination to modern people. There is also the being able to make generalizations about how men were moving from a life of hunting and wandering to settlement in villages, then towns, and finally cities. The story of how this happened, presumably first in the Middle East between the Nile and the Indus Rivers, is not very clear because the record is not very clear.

Why the Growth of Cities?

To many people, the invention of something like a city, with its complex religious and social and military institutions supported by surplus food, looks so complicated that one must invoke something close to a "god out of a machine." In a view like this one, cities would have sprung into being in, at most, one or two places where the complex forces were just right. Perhaps it would have been in the valleys of the Tigris and Euphrates, lacking almost all resources except water, soil, and reeds and needing a more complex organization to handle growing numbers of people. This event would have been almost like a stone falling into a pond, creating ripples flowing outward, carrying the pressures toward city life with them. (*See "Cities in the Beginning," by Arthur R. Steinberg in* Technology Review *for March, 1968.)*

There is mounting evidence that this ultra-diffusionist view of the birth of cities may not reflect the facts. The evidence goes far beyond the fact that the patterns of city life sprang up in apparently almost total independence in such places as China and Mexico much later than in the Near East, and that there is evidence of a real "dark age" over much of what is now Iran, West Pakistan, and India between 2000 and 1000 B.C. In such a period, the supposedly overmastering influences of the metropolis must have lost their diffusionist power.

New archaeological findings point to the idea that city life may have sprung up under widely varying conditions within a period as short as a couple of hundred years all over the Middle Eastern region between the Nile and the Indus.

The strongest evidence for this view has come to light in the 65-foot-high mound called Tepe Yahya in the desert of southeastern Iran, south of the Iranian city of Kerman and not far from the mouth of the Persian Gulf.

There, for the past four summers, an expedition from Harvard's Peabody Museum, operating with the full cooperation of the Iranian antiquities services, has been uncovering sophisticated tablets and seals and bowls as well as a nearby strip mine—the only one in the Near East—for the soapstone known as steatite. In levels of the mound dated between 3400 and 2500 B.C., the Harvard expedition has found steatite bowls and other luxury items in various stages of completion, indicating they were made there from the local steatite (this last point is now being checked with neutron activation analysis).

Near finished tablets with inscriptions in the language known as proto-Elamite (similar to the inscriptions of the same date from Susa in western Iran) are many fresh tablets apparently awaiting inscription. The tablets seem to record either the receipt of grain or the amount of such grain due from given plots of land.

These levels of the mound—of which about 1 per cent has been excavated—point to a sophisticated administrative center, presumably belonging to a local chieftain who engaged in trade in grain and luxury objects. The objects are identical in style and materials with objects found in many sites of similar date in Mesopotamia, sites from the pre-Sumerian era.

There is no clean break between the levels of the mound devoted to administration and those below, where material has been dated back to 4500 B.C. The earlier levels of the mound are occupied by simple agricultural dwellings.

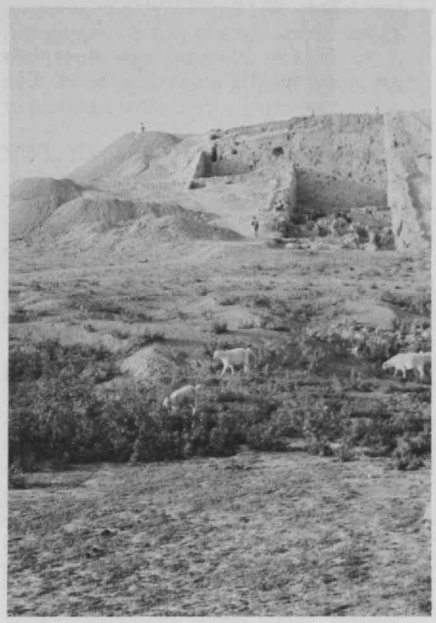
The indications point to a locally evolved culture of a high level, independently trading with pre-Sumerian Mesopotamia—and probably also with cities in the Indus Valley like Mohenjo-Daro.

Professor C. C. Lamberg-Karlovksy, the 32-year-old Czech-born leader of the Tepe Yahya excavations, reports that objects at Tepe Yahya match up with some of those found at Indus Valley sites. He thinks that this will require careful supplementing of the current series of radiocarbon dates—painstakingly done at the Tata Institute of Fundamental Research in Bombay—which limit the Indus Valley, or Harappan, civilization to the period between 2300 and 1700 B.C.

The nondiffusionist view of the origin of cities with a highly developed culture gains support from studies of the village and town life that went before it, gradually elaborating in the period between 9000 and 3000 B.C. and developing such things as an elaborate trade in obsidian (a brittle volcanic glass). Obsidian was often carried hundreds of miles from its few places of origin to the many places it was shaped into tools, bowls, even a sculptured imitation seashell found in Minoan Crete.

Three English researchers, J. E. Dixon, J. R. Cann, and Colin Renfrew, commented in a *Scientific American* article (March, 1968) about the implications of their analysis of neolithic obsidian trade in the Mediterranean and Near Eastern worlds: "The analysis of the early obsidian objects now throws new light on the revolution, some 10,000 years ago, that led to man's emergence from the hunter's way of life.

"There has been a tendency to think of this beginning as an isolated, small-scale phenomenon—of a little group of people settling down somewhere and developing an agricultural system all by itself. In recent years, an intensive search has been pursued for the 'birthplace' of this event:



By the fourth summer of excavation (1970), the 65-foot mound at Tepe Yahya, Iran, had yielded evidence of a sophisticated administrative center dated between 3400 and 2500 B.C. to the Harvard archeological team responsible for its discovery and development. Urban life apparently began almost simultaneously in many parts of the Middle East. (The photograph at the right shows the conditions of excavation in one room of Tepe Yahya; the black-and-white stick is one meter long.)

Did the first village spring up in the Levant or in the Zagros Mountains or the rim of the Fertile Crescent or in Turkey? That question now becomes less interesting or significant than it was thought to be.

"The farming way of life, it appears, originated not at some single location but over whole regions where the peoples of various settlements exchanged ideas and the material means of sustenance."

The ideas of these English workers, who are analyzing obsidian from the Tepe Yahya site, match those of Lamberg-Karlovsky about the possible significance of the site in eastern Iran, about halfway between the Tigris and the Indus.

Experiments in Social Organization

Also being eroded are the ideas that great natural disasters or changes in climate—possibly leading to severe drying out of the land—forced the pace of urbanization. H. E. Wright of the University of Minnesota, writing in *Science* magazine (July 26, 1968) about the influence of climate change on agriculture, indicates that the climate in the Zagros mountains became warm around 9000 B.C., possibly helping create conditions where a group of animal hunters could have started cultivating primitive game and domesticating pigs, sheep, goats and oxen.

Although Wright argues that the evidence for a link between climate change and the launching of animal domestication and agriculture is getting stronger, he acknowledges that he has "always felt that cultural evolution, gradual refinement of tools and techniques for controlling the environment, is a stronger force than climatic determinism in the development of early cultures."

Many archaeologists have reported little evidence for much climate change after the start of settled agricultural life in which, according to Frank Hole of the University of Texas, "people settled down where they could raise large amounts of grain, store it for the future, and exchange it for products they did not produce. In return for dependability of food supply, people gave up some dietary variety and most of their mobility."

Writing in *Science* for August 5, 1966, Hole cites studies by Wright and others indicating little climate change in the 5,000 years before the first cities sprang up. "The development of urban civilizations doubtless depended more on sociocultural factors such as trade, surplus production, and economic interdependence than on geography per se."

Hole also wrote, "It seems unlikely that Mesopotamian society took a single path as it approached the rigidly organized, hierarchical civilization of Early Dynastic times (the temple cities around 2500 B.C.). Rather we imagine that there was considerable experimentation and variety in the organization of society as people adapted to their physical environment and to the presence of other expanding communities."

Luck and More Luck

Although there are many complex intellectual issues connected with the excavations at Tepe Yahya, there also was an element or two of luck in the discovery.

To be sure, the late Sir Aurel Stein had carried out a survey in 1934 in the area, which is known as Iranian Baluchistan. Stein, whose collections on that trip are in the Peabody Museum in Cambridge, was looking for a center of trade lying somewhere between the site of Ur in Mesopotamia, being excavated by Sir Leonard Wooley, and Mohenjo-Daro on the Indus, being excavated by Sir John Marshall.

In the summer of 1967, Lamberg-Karlovsky's work in Syria came to an abrupt end because of the Six-Day War. As a substitute, it was decided to revisit the area Stein had surveyed.

Lamberg-Karlovsky reports that 11 weeks of hot travel by Land Rover, donkey, and foot apparently indicated that Stein had covered all the important sites, none of which were suitable "for full-scale excavation, being either very badly eroded or of very short duration in occupation."

But on August 21, 1967, diverging from Stein's path, the Harvard group crossed a mountain range and spotted on a plateau below "an archaeological mound which our survey had not conditioned us to expect—too large!" Thinking it might be Islamic, but still with a glimmer of hope, the party approached and began finding broken pot fragments, none of them Islamic. Some of them indicated occupation as far back as 4000 B.C or earlier.

A preliminary excavation into the mound, which is 65 feet high and 450 feet in diameter—with ancient fragments scattered for a mile in every direction—showed Lamberg-Karlovsky and his colleagues that they had "found the site which had eluded Stein and at least four other archaeologists . . ."

The site, Lamberg-Karlovsky noted, "would rank as a large [one] even in the more nuclear centers of Mesopotamia."

There was more luck to come. In the summer of 1970, the steatite mine was found by accident on a picnic excursion to a nearby Islamic shrine.

Present on both occasions was Gholam Ali Shamlou of the Iranian Archaeological Service, who will come to Harvard to begin graduate studies next summer.

Victor K. McElheny, who contributes regularly to Technology Review, is Science Editor of the Boston Globe.

European Report II
Philip Mandel

The mammoth tankers now on the seas—and the even larger ones being planned—have stimulated new research in towing tanks throughout Europe and in Japan. But some experimenters are encountering major difficulties in predicting power requirements and many are dealing with the giant ships' reduced maneuverability.

Mammoth Tankers: Reviving the Towing Tanks

The spectacular increase in the size of seagoing oil tankers represents one of the most striking of recent engineering developments. Tankers' carrying capacity and total weight have increased by factors of ten and more since 1950, and the end is not yet in sight. Twelve-hundred-foot tankers of 300,000 tons displacement (three and a third times the displacement of America's mightiest aircraft carrier) are now in service. A megaton tanker (about 1,600 ft. long) is expected to be ordered soon.

This development has not been without its major problems. Everyone is aware of the problem of catastrophic oil spills when even a small tanker is damaged by collision, by grounding, or by tank explosion. Recent accidents of this kind have acted to increase insurance rates considerably, and this has dampened but not stopped the ardor for further growth of tanker size. Unknown to the public—but very much in the minds of oil company naval architects and management—are other problems in ship maneuvering, vibration and power prediction which are concerning those who study, design and build and—to a certain extent—those who operate these immense ships.

Almost none of the substantial research aimed at alleviating these problems is being done in the U.S.; rather the oil industry is supporting this research abroad. The work is being carried out primarily in Japan, West Germany, Great Britain, the Netherlands, Denmark, Sweden, Norway, and France. Why is this so? For reasons deeply rooted in national attitudes towards ships and shipping, those countries are equipped with several excellent ship model towing tanks, eager to be responsive to industry's needs. The U.S., in contrast, has only one major ship model towing tank establishment, (at Carderock, Maryland) and that is mostly devoted to the U.S. Navy's problems. However, it too has recently inaugurated a project dealing with the mammoth tanker hull form and small programs have also been underway for some time at the University of Michigan and at the State University of Iowa.

The problem of most interest to ship model experimenters is that of predicting, before a tanker is built, the amount of power that must be installed to propel it at its specified speed. This is the gut problem for which model tanks were built beginning back in the late 1800's. But after years of comparative success, at least one towing tank is encountering major difficulties in dealing with some mammoth tanker forms.

The laboratory most concerned with this problem is the National Physical Laboratory (N.P.L) Ship Division in Feltham, England, whose towing tank is 1,300 ft. long, 48 ft. wide and 25 ft. deep. The British government, anxious to retain Britain's position in the world shipbuilding market, is supporting work with mammoth tankers at N.P.L.

It is not the size of the new tankers that has posed the new problem for N.P.L. The size of the models tested is determined by the dimensions of the available facilities, and to expand the results of a 20-ft. or 30-ft. model to a 600-ft. ship (scale ratio 30 and 20, respectively) poses just about as many problems as expanding the results to a 1,200-ft. ship. Rather it is the hull form of the tankers that has posed the new problem for N.P.L.

All modern tankers have very full hull forms, but one N.P.L. designed megaton tanker is even fuller. Naval architects quantify fullness by what is called the block coefficient, the ratio of the underwater volume of a ship to the volume of a rectangular block of identical length, beam, and draft. N.P.L.'s megaton tanker has a value of block coefficient of about 0.9 compared to block coefficients of 0.4 to 0.5 for highspeed liners, 0.65 for medium-speed cargo ships, and 0.8 for existing tankers. It has an angle of entrance of 180°.

Full forms have been selected for tankers as a result of simple economic reasoning. Both ship construction costs and skin frictional drag are minimized by minimizing ship dimensions, and it is evident that a large block coefficient results in minimum dimensions for any given required underwater volume. Of course, it was known that maximizing the block coefficient would also increase separation drag significantly, but even if this is taken into account as well as is known how, the economics still favor large block coefficients.

Unpredicted Scale Effects

Experience with large tankers in service (block coefficients $\leqq 0.82$) has validated the foregoing reasoning, but grave scale effect problems have arisen with the N.P.L. block 0.9 form. For example, drag measurements of two geometrically similar models of this design, one 20-ft. and the other 30-ft. long, expanded to a common single full size by standard model basin techniques, have shown very significant drag differences, the lower drag resulting from the measurements with the longer model. Such large scale-effects have not been experienced at N.P.L. with finer hull forms.

One possible explanation is a variation in the extent of flow separation with model size. Flow visualization tests in the superb circulating water channel at N.P.L. have shown the existence of separation not only at the sterns of these models (some stern separation is fairly common even with finer ship forms) but also at the bow. These tests show that large-diameter vortices are generated close to the bow at the turn of the bilge and extend aft, all the way to the stern. Such vortices have been observed to occur with several tanker models at N.P.L. Evidently the downward flow of water around the bow of some full-form ships separates when it reaches the relatively sharp turn of the bilge which is characteristic of these ships, and in the process generates the observed vortices.

Standard towing test techniques are not valid for models that suffer such extensive flow separation; they are only suitable for predicting the drag of ships which experience little separation drag. To simulate in model scale a ship's viscous flow conditions, which is essential to properly simulate separation, would require that the model be tested at the Reynolds scaled speed which is the product of the scale ratio times the ship speed; thus a 20-ft. model representing a 1,200-ft. ship intended to travel at 15 knots would have to be towed at 900 knots or about 1,500 ft. sec. (In contrast, in a conventional tank test, the model would be towed at a Froude scaled speed, which in the cited example

amounts to only 2 knots.) No model tank is equipped to tow at such speed and, if such tests were possible, all kinds of new intractable scale effects would have to be dealt with.

N.P.L. has commissioned the services of the University of Glasgow Experimental Tank to help them sort out their scale effect problem. But in the meantime, other towing tanks dealing with existing tanker forms of block coefficient lower than 0.82 have shed new light on the drag of these ships.

Bulbous Bows—A New Explanation

Bulbous bows have been used for decades to reduce the wave making drag of relatively high speed ships in accordance with the well understood principle of wave cancellation. About eight years ago it was discovered that installing bulbous bows on tanker models reduced their drag by a large fraction—about 15%—in the no cargo, ballast, condition. Since tanker speeds are very low in relation to their length, wave making drag, which is quite large on high speed ships, constitutes only a tiny fraction of their total drag; certainly less than 15%. Thus the wave cancellation principle could not account for the bulb action in reducing tanker drag.

In the absence of a thorough investigation (the oil companies didn't particularly care why the bulbs were effective) it was the fairly common belief among knowledgable people that bulbs on tanker forms reduced drag by reducing their viscous drag. The N.P.L. discovery of the bow vortices on a tanker model in 1967 helped fortify this belief. In the meantime, the oil companies proceeded to backfit bulbs to existing tankers as well as to incorporate them on new designs. More than 100 tankers owned by one oil company now have bulbs. It has been estimated that if effective bulbs were installed on all the tankers of the world, it would result in the saving of over $100,000,000 in annual petroleum transportation costs.

In a paper presented in Berlin in November 1970, Dr. S. D. Sharma of the Hamburgische Schiffbau Versuchanstalt (HSVA) and an author from the Esso International Oil Company offer a new phenomenological explanation for the bulb effect on tankers that accords with all observed facts. In addition their explanation has been confirmed by independent but simultaneous work at the Mitsubishi Industries in Japan. Both of these works discredit the viscous flow theory of bulbs by showing that the total drag of double reflected tanker models, (in which the "above-water" part of the ship is replaced by a mirror-image of the underwater hull form), towed in the deeply submerged condition, away from the free surface, is unaffected by the presence or absence of a bulb.

Only tests at the free surface, where wave making effects were present, revealed the 15% (or so) advantage of the bulbs. However a wave cut analysis with the models at the free surface, the traditional means of determining wave making drag, also failed to reveal any advantage for the bulbs. Finally, very elaborate and costly wake surveys were made in a transverse plane aft of the towed models both with and without bulbs. These surveys showed the existence of distinct wake concentrations outboard of the beam of the model without a bulb that were completely absent on the model with bulb. It was also observed that the model without bulb generated very severe breaking waves at the bow whereas the model with bulb generated only non-breaking waves. It was concluded that the energy of the breaking waves was transferred in the breaking process to turbulence in the water, hence it could not be determined by the wave cut analysis; however it was picked up by the wake survey aft of the model. Thus a new component of ship resistance called the wave breaking resistance, heretofore unidentified, was discovered. This drag component is evidently significantly reduced by a properly designed bulb.

The Berlin paper also presented evidence from full scale speed trials with many tankers with bulbs that conclusively confirmed the model predictions of reduced drag in the ballast condition. Thus N.P.L.'s troublesome experience with scale effect is apparently associated with the particular models that they have treated. HSVA and the oil companies are convinced that there are no scale effects affecting their bulb predictions.

Power and Maneuverability

Of much greater public concern than power prediction is the deterioration of maneuvering qualities which has accompanied increased tanker size. The primary cause of this deterioration is the fact that while the displacement of tankers has grown over ten-fold in two decades, power plant output has increased only three-fold from 10,000 to about 30,000 h.p. The reduction in sea speed associated with this fact has not been serious, because the drag per ton of displacement decreases significantly with increasing displacement. But the degradation in the ship's maneuverability in restricted waters has been serious. The problem is dramatized by two facts:

The stopping distance of a mammoth tanker from an initial ahead speed of only 12 knots with its propeller rotating full astern is more than a mile and a half.

Thirty thousand installed horsepower in a 1,200-ft. tanker is the equivalent of about one-third h.p. in a 40-ft. model. Any small boat operator can appreciate the difficulties of handling a 40-ft. boat with only one-third h.p. at his command.

The primary response of the oil industry to this problem has been to improve masters' skills in handling these ships; some have also commissioned towing-tank studies of water-braking devices for large ships. An early attempt to improve masters' skills took place at Lake Revel near Grenoble, France, where the major navigational hazards encountered on typical tanker ocean routes and at deep-water anchorages were modelled. There masters learned of some of the problems of handling mammoth tankers by operating 40-ft. self propelled models of these ships equipped with fractional-horsepower propulsion plants.

A more suitable training facility just being completed is the $1 million Ship Maneuvering Simulator being built by the Netherlands Ship Model Basin at Wageningen, with the advice and help of the Delft University of Technology. In addition to training tanker operators, this facility will be suitable for research on additional displays to be introduced on the ship's bridge to assist the operators. A major problem that could not be simulated with the model facility at Grenoble is that the responses of a mammoth tanker to rudder signals or other disturbances are so slow that a human being cannot perceive them early enough to take corrective measures. Displays showing detailed information about the ship's motions and angular accelerations could alleviate this problem, and these will be studied with the simulator at Wageningen.

Other work concerned with maneuvering the mammoth tankers is going on at the Hydrodynamics Laboratory in Lyngby, Denmark; at the British Ship Research Association at Wallsend, England; and at the Ship Model Tank at the Technical University of Norway, Trondheim. The latter establishment—along with similar groups in Gothenburg, Sweden, and the HSVA—is also heavily engaged in studying the vibration problems of mammoth tankers which are of direct concern to the operators themselves.

Taken as a whole, the volume of research and development on the problems of mammoth tankers under way in Western Europe is not inconsiderable. But even more impressive to this writer was the constructive ferment induced in the ship-towing-tank community by the introduction of a hull form that was simply fuller and bigger and slower in relation to its length than any of its predecessors.

Philip Mandel is Professor of Naval Architecture at M.I.T. While on sabbatical leave from the Institute in 1969-70, he was on the staff of the Office of Naval Research, London, where his duties took him to most of the naval architecture centers in Western Europe.

European Report
Peter Stubbs

The opportunity of taking part in N.A.S.A.'s post-Apollo program resulted in a deep division of opinion among European countries—a division with complex ramifications

European Space in Pieces

One summary of the giant split that has riven the European space program from top to bottom since last November is that never has so much furore been generated on the basis of so little hard fact. But politics have taken over the scene to the almost entire exclusion of rational procedures.

Aerospace lobbies apart, we in Britain have tended, ever since Sputnik I in 1957, to regard space technology as a means to certain ends, either scientific or commercial. While admiring the spectacle of Man in space, we have generally remained sceptical of his practical value up there. And, indeed, not many weeks ago I asked Professor Hermann Bondi, retiring chairman of the European Space Research Organization (ESRO), specifically whether he knew of any objective studies which had been undertaken to assess what particularly it is that Man in space could achieve vis á vis automatic devices. He was unable to call to mind any—but did concede that such a study might be a useful thing to do.

It is against such an unsatisfactory backdrop as this—not to mention strong rumors here of the secondary, almost ribald, status to which serious science has been relegated in the Apollo program—that the British government put its foot down at the November ministerial meeting of the European Space Conference held in Brussels. Whatever our European colleagues may have felt about the matter, emphasized Mr. Frederick Corfield, U.K. Minister of Aviation Supply, we were simply not going to be railroaded into signing a blank check for an as yet far from specified share in an as yet far from specific program.

This is not to say that, should the current $2½ million-worth of careful assessment of N.A.S.A.'s proposals come up, around mid-1971, with something positive to offer, we might not opt to join forces—with or without the rest of Europe. The space-shuttle/station/tug concept has some attractive features, not the least of which is the prospect of reducing the cost per pound of payload orbited by a factor of around ten. But the investment to gain this gross discount is not small—some £100 million over ten years on the part of the U.K.—and nobody buys an E-type Jaguar to go and mail a letter.

So what is "post-Apollo" good for? How much are we Europeans likely to want to make use of it? How well will it boost our advanced technology (apart from filling the aerospace industry's coffers)? And might not the ingenuity demanded for the design of automatic orbiting stations promote even that end rather better than would the design of cumbersome life-support systems?

But politics has now bedevilled all chance of answering such questions dispassionately. Within Europe, Britain's French and West German partners have never forgiven her for welshing on them over the—by U.S. standards archaic!—Europa launcher. Underlying this bitterness is a fear that without an independent launch vehicle to orbit commercial satellites, Europe could never compete on fair terms with the U.S.

Perhaps, in principle, this is a realistic view. In practice, however, Europa has had an unhappy history which, even were the Europa III rocket to prove successful, generates little faith in the European Launcher Development Organization (ELDO) when matched against the wealth of U.S. experience in rocketry. The U.K. view, conversely, is that Anglo-U.S. relations will continue to ensure an adequate supply of American launchers.

At Brussels the British ministerial team were riled by a request from the Belgian chairman, M. Theo Lefevre, for a further $35 million, allegedly for the post-Apollo assessment studies but actually, it transpired, for research and development work on Europa III. Regarding this move as something of a "fast one," the British retired in a huff, but supported by some of the smaller European Economic Community nations including Italy and Holland. France, Belgium, and West Germany, however, who are apparently uncritically and wholeheartedly prepared to commit themselves *now* to the post-Apollo proposals, regarded the U.K. move as a deliberate disruption. They in turn were riled by, among other things, the non-Cabinet status of Mr. Corfield. And what in one light looked like no more than reasonable British circumspection created a gaping wound in European confidence.

Rubbing salt into this already smarting sore, the French towards the close of the year threatened to slash ruthlessly their budget contribution towards ESRO's proposed applications-satellite program (it included the Euro-N.A.S.A. air-traffic-control satellite project, and a European communications satellite, in the immediate future; and a meteorological satellite at a later date).

Beneath the European tussle of threat and counterthreat, of course, run deeper waters: France's desire for her own telecommunications satellite system to propagandize former African colonies; West Germany's urge to become a fully fledged space power; the British government's intense anxiety to enter the Common Market—even possibly, in part, by blackmailing its way in over the space program. (*We'll* join one, if *you* let us join the other.) What makes the situation hilarious in one respect is the way European space cooperation was being heralded as a model by both U.S. and U.S.S.R. space administrators at the International Astronautical Congress in Constance, as late as October last year.

But, if there is a real future for space activities, and European space collaboration founders, it will be a pity. ESRO, at least, has built up a competency which should not be allowed to go by the board simply because a bunch of politicians can't decide to what proper purpose it should be put.

Dr. Peter Stubbs is Science Editor of the British weekly New Scientist. *Before he turned to journalism he was a geophysicist, specializing in rock-magnetism.*

FEATURES

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Innocence and Experience

Romantic Road to Reform

Children and Science
Lazer Goldberg
Scribner's, 1970, $5.95

Reviewed by
George E. Hein
Associate Professor of Education
Boston University

In a chapter titled "Head and Heart," Lazer Goldberg urges a teacher to build a community in his classroom, "a place not governed by a scarcity economy of good feelings that are rewards of pleased adults, but one filled with activity . . . where joys and sorrows as well as knowledge are shared, where teachers' efforts are characterized by a profound respect for children." Goldberg's book falls into what I would consider the romantic end of the spectrum of the movement, whose other pole I would call radical.

All the proponents of the school reform movement are critics of the present state of American education. They point to our absolute failure to educate a large minority of our children and to the stilted, test-centered curriculum of even those suburban systems where children at least learn to read and to go on to college. There is wide recognition of English examples and of a number of smaller attempts in this country. There is also a great faith in the goodness of mankind, or at least of children, and the ensuing conviction that, provided with the properly protected surroundings, a wealth of materials, and a minimum of negative influences, children will learn and grow up to be healthy, creative, intelligent citizens able to deal openly with the world around them.

The most powerful products of the reform movement have been the descriptions of how awful things really are and the illustrations of individual alternatives. Goldberg gives marvelous examples of children's involvement with science, from creative play with balloons to sophisticated measurements and experiments inspired by pendulums. He shows how these activities arise from the free, creative, rich environment he sponsors.

What is disturbing to me about the romantic wing of the movement is that the descriptions of alternative possibilities fail to appreciate the realities of the American political situation. They simplify the problems and avoid some of the hardest questions. I agree that in order to foster learning in general, or learning in science in particular, one must create the proper atmosphere in the classroom. But I think it is naive to assume that this atmosphere can be created by the individual classroom teacher in American society today. For example, if we confront racism—just one of the evils of American society—we begin to see the magnitude of the task. Black students, who are some 30 per cent of our subjects, learn every day that they will remain poor, oppressed, and disenfranchised. This is brought home to them on the streets and in their encounters with all kinds of authority (including the schools). How can any classroom situation make a significant impact against that overriding reality?

Another shortcoming of the romantic wing is its tendency to provide little help in the nitty-gritty of school reform. Unfortunately the creation of an exciting classroom is a difficult achievement which requires much time, enormous resources, experience, and considerable day-to-day work. Goldberg only hints at the ways to do all this.

But to dwell too long on the shortcomings of this romantic vision is unfair for two reasons. First, some of the problems which come with providing freedom for children are truly unsolved; Lazer Goldberg is neither the first nor the last person who cannot deal with them satisfactorily and definitively. You cannot both provide freedom and a rich environment and then dictate what children will learn and what they will enjoy. It takes enormous courage to advocate and carry out a program where anything may happen, limited only by "those things which clearly threaten [the children's] safety or health," where play is accepted as a learning activity, and error and failure are recognized as "normal in scientific work." Without faith, the will would be lacking and without will the kind of evidence and checks and controls demanded would negate the effort.

Second, the romantic vision of school has a powerful message, both in contrast to what is happening and in depicting what can happen in some situations. *Children and Science* is full of wonderful observations about what can happen when children are free to interact with the "stuff" of the world. Much of the book is a veiled description of what has happened in classes to which, presumably, Mr. Goldberg has brought balloons, pendulums, animals, and blocks. A practicing classroom teacher would want a more direct description. Where did you get the stuff? Where did you store it in the classroom? How did you deal with the custodian and the principal? But everyone concerned about working with children in science can get a sense of the potential in the open, rich method.

He tells us that there is no paradigm for the solution of problems, that to do science one must simply ask questions, and that no models—however ingenious—are a substitute for live animals and plants. More than that, he shows how such views can and should be translated into an active program.

But, unfortunately, again the shortcomings of the romantic movement confront us. Goldberg's intentions are marvelous, his arguments compelling and his descriptions appealing; but more is needed, because the problems are tougher than portrayed. In the chapter he points out that the "essential features of an appropriate climate [for children to do science] derived from the practice of science and the experience of children are anti-authoritarianism and democracy; high tolerance for dissent, argument, and failure; regard for aesthetic reward; absence of fear and humiliating measurements; emphasis on cooperation rather than competition; respect for manual as well as intellectual effort and, above all, interesting and significant activity."

To argue that all those virtues characterize the appropriate climate for science is just as nonrealistic as it would be to argue that science is characterized by *the* scientific method where the sequence hypothesis-experiment-theory always takes place.

It is precisely because "there is no

Which rolls quicker down a slope, a ball or a cylinder? The photograph is from a study of how children can discover their own science, in which reviewer George E. Hein was involved. In his review of Lazer Goldberg's Children and Science *he warns against neglect of the awkward practicalities of the classroom.*

known formula to describe scientific methodology" that we need situations with many alternative ways of behavior to provide means for many children to do science. As soon as we create open situations where anything can happen, it will. There will be instances of joyous activity, but there will also be inactivity and disinterest. There will be open-minded discussion but also browbeating and sanctions. There will be appeals to evidence and demonstrations as well as display of arbitrary power. If we decide to accept science (or any other human activity) as it is, we will have to put up with its problems.

In a chapter on error and failure, for which he is to be commended, Goldberg gives the example of a disagreement in class, when one lone child holds out for one view while the rest of the class argues another. Finally, experiment proves the lone dissenter correct and the rest of the class accepts the defeat. It's a nice story, but it doesn't always work that way. The hard question is, what does the teacher do when things go the other way, when the majority overrides the sole voice, a result common in science and in the classroom?

Children and Science is hardly *the* definitive book on science education of this decade. But it makes a noble plea for the type of education we need, if we are to have any hopes for the future.

The Sky Was the Limit

America Adopts the Automobile, 1895-1910
James J. Flink
Cambridge, Mass., M.I.T. Press, 343 pp., $12.50

Reviewed by
Deborah Shapley

Three-quarters of the way through this century, half the air pollution in the United States is caused by the automobile. Accidents involving cars kill an estimated 52,000 people yearly. Obsolete or wrecked cars are a fair portion of the solid waste junked on our landscape. And recently, John A. Volpe, Secretary of Transportation, said that there is one car for every other man, woman, and child in the country and that cars are increasing at double the rate that people are!

Yet the manufacture, sale, fueling, and repair of automobiles absorbs seven of the ten largest U.S. corporations. These industries produce one-third of the cars in the world.

U.S. auto, oil, and steel interests have much in common with that other whipping-boy we were talking about at this time last year, the "military-industrial complex." All are deeply rooted in the country's economy; all consider their own steady growth with minimum disturbance of their operations in the national interest. And all have been challenged lately by much smaller Davids seeking fundamental changes and backed by a tide of consumer-voter disillusionment with their finished products, whether it is the war in Vietnam, the F-111, the Corvair, or the internal-combustion engine.

It is interesting, then, to look back at how America was sold the automobile in the first place. But there's the rub. She wasn't sold anything—she bought it —gladly—believing that the car was going to be the answer to everything.

James J. Flink, in this first volume of a two-book series, gives a thorough, historical account of the early rise of the auto in America from 1895 to 1910 (the second will cover the development of mass production from 1910 onwards). And, like all really good history, his book makes us think harder about the problems we face today.

Antique auto buffs will like the volume, particularly the plentiful statistical material on early owners, manufacturers, and clubs, and the book's format and design. The general reader, with scant historical background, won't be lost either. The author brings in nicely the colorful background to his subject: the Progressive Era in American life when a newly urbanized and industrial nation barrelled along in the prosperity and optimism that characterized the years before the Great War.

The main drama of the book is the story of the public's rejection of the horse as a means of mass locomotion and embrace of the concept of a car for every man (a romance, incidentally, much talked about long before it ever reached fulfillment.)

The story began back in 1860 in France when mechanic Etienne Lenoir took out the first automobile patent. Forty years later, literally dozens of American bicycle manufacturers, machinists, and entrepreneurs began modeling their own cars after the European imports (you needed very little capital to make cars: Henry Ford started Ford Motor Co. in 1903 with only $28,000 paid in and 12 employees).

The idea of the car for every man was conceived, born, and raised largely thanks to the press of the day. In fact, accounts of the new invention were so rosy that manufacturers complained that their machines weren't that good! Another main reason for public acceptance was car races, beginning with Alexander Winton's 1899 run from Cleveland to New York City with a journalist, Charles B. Shanks, on board, producing gleeful copy.

From very early, the car had an image of being the good servant of man—unlike horses, which were temperamental. Along with engineers, doctors were the first purchasers of cars. Clearly the improved medical care that came with the local doctor's purchase of an auto

Around 1907 actress Virginia Harned (with parasol) rode through Central Park in the latest invention—a horseless victoria carriage—and had her photo taken to commemorate the event. Sixty-four years later, Central Park is the only (apparent) refuge from "horseless victorias" within a radius of 10 miles, and at the center of one of the nation's largest daily disasters, the New York traffic jam. One historian outlines how the auto evolved from a toy of the idle rich into a principal item of middle-class consumption.

helped give it a good reputation. Then, in 1906, San Francisco experienced the worst earthquake of its entire history, and the car gained new fame. The terrain was impassable by horses, and authorities rushed as many cars as possible to the scene. Accounts of the savings of lives and property thanks to the untiring, fearless automobile, insured the automobile its place on the American scene, believes author Flink.

At first the car was simply a luxury item for rich businessmen who put it in their stables alongside their horses. Hence the origins of the early auto clubs—elite societies where the owners would sit smoking in oak-panelled rooms while their hired chauffeurs and mechanics toiled in garage spaces beneath. This kind of club died as soon as the auto became a middle-class consumption item. When the average man went to buy a car, he had to mortgage his house (then, a daring move)—and he wasn't about to take out a second mortgage for chauffeur, high club dues, and smoking jacket.

Remarkably, the Neanderthal state of automotive technology proved no barrier to public acceptance. Steamers and electrics had many of the same technical problems they do today—but they were sold as fast as they could be built. Even before the right class of metals had been found to build a reasonably durable but lightweight vehicle—the vanadium steels, introduced by Henry Ford—over 200 companies were making and selling cars. Even the dramatic accidents of the early period—and the dutifully sensational press reports of them—failed to sour the public romance. People went right on buying cars and voting for candidates such as William Jennings Bryan, who campaigned from town to town in one of the newfangled "machines."

The lexicon of this acceptance parallels the automobile's design evolution. At first they were "horseless carriages" and the first motor magazine, in 1895, was *Horseless Age.* Sure enough, cars of that period looked just like buggies, with spidery wheels, a high seat, canopy, and an engine tucked inconspicuously underneath. But later, when the big, sputtering internal-combustion engines dominated, the front of the low-slung, small-wheeled vehicles, journalists and commentators shortened "automobile carriage" to "automobile." Or they simply called them "machines."

Flink points out that the main motives for the mushroom market for cars in this country lay "in the core values of American culture." Among these were the "high value traditionally placed upon geographic mobility" for which the auto was obviously superior to the horse. Another was independence. The car offered "the freedom from timetables, from fixed and inflexible routes . . . and the satisfaction that comes from a knowledge that one need ask favors or accommodation from no one," said *Harpers Weekly* in 1909.

The prestige and material status of owning a car was central to the turn-of-the-century American, too. "Many who never felt they were in a position to purchase a horse and carriage . . . now indulge in automobiles costing several thousand dollars originally . . ." said the *Independent* in 1908. "So mad has the race for social supremacy become in the East End," complained *Horseless Age* in 1907, "that owners of houses are mortgaging them to buy as many and as speedy automobiles as their neighbors. Extravagance is reckless and something must be done before utter ruin follows in the wake of folly!"

In the light of our present transportation-pollution-safety muddle, check Flink's list of the problems which the public thought the auto would solve: *Health.* The elimination of dung from city streets would improve sanitation, lower city taxes, and raise general health. *Safety.* Cars were obedient, especially for young drivers and women who could not control a team of horses. *Longevity, hence economy.* "Few cars become so worn or decrepit that they are actually thrown on the junkheap," rejoiced *Country Life in America* in 1909. *Transport efficiency.* In the early 1900's, several municipal experiments with motorbuses were becoming expensive and clumsy to manage. Hence, many city officials welcomed the individually owned automobile, arguing that it would be cheaper and faster as a general mode of transport. *Betterment of the working man (newly urbanized).* 1970 commuters should take note of the *Independent's* vision (1904): "Imagine a healthier race of workingmen, toiling in cheerful and sanitary factories, . . . who, in the late afternoon, glide away in their own comfortable vehicles to their little farms or homes in the country or by the sea. . . . They will be happier, healthier, more intelligent and self-respecting citizens because of the chance to live among the meadows and flowers in the country instead of in crowded city streets."

When, in the year 2000, the air is so polluted that we can't see through our windshields anymore, and the cars are packed together on the roads so tightly that to walk is again the safe (and only) way to travel, some mad inventor in a barn in France will bring forth the thing which will *really* solve the American transportation crisis: the horse!

"Scientist-astronaut Anthony W. England stands (sic) inside an improvised shelter made of parachute material, in dense jungle area near Albrook Air Force Base, Canal Zone. England and other scientist-astronauts underwent five days of jungle survival training at the U.S. Air Force Tropic Survival School." (N.A.S.A. press release, August, 1969) In a recent historical study, John M. Logsdon has attempted to articulate the reasoning that really underlay the Apollo program.

Bright Honor from the Pale-Faced Moon

The Decision to Go to the Moon: Project Apollo and the National Interest
John M. Logsdon
Cambridge, Mass., M.I.T. Press,
187 pp., $10.00

Reviewed by
Fred Wheeler

In December, 1960, the President's Science Advisory Committee presented their *Report of an Ad Hoc Panel on Man-in-Space* to President Eisenhower. The report—a study of N.A.S.A.'s program as it stood then—estimated that a manned lunar landing around 1975 would cost $26 to $38 billion over and above the costs of the Mercury program and a circumlunar-orbit program.

"Eisenhower," Logsdon writes, "asked for an explanation of the reasons for undertaking such an ambitious and expensive program. In the ensuing discussion, the lunar journey was compared to Columbus' discovery of America, a voyage financed by Spain's Queen Isabella. Eisenhower reacted to this argument by asserting that he was 'not about to hock his jewels' to send men to the moon. The general reaction of the meeting was one of almost sheer bewilderment—or certainly amusement—that anybody would consider such an undertaking. Somebody said, 'This won't satisfy everybody. When they finish this, they'll want to go to the planets.' There was a lot of laughter at that thought."

Eisenhower may not have been riding the wave of the future, but he had the last laugh. What followed was an age of triumphant solemnity: Logsdon's source for the innocuous anecdote above asked to remain nameless.

On January 20, 1961, John F. Kennedy became President. On April 12, the U.S.S.R. orbited Gagarin. The immediate reaction of the new President, in public at least, was philosophical, in contrast to the "atmosphere of panic, almost hysteria" which pervaded the House Committee on Science and Astronautics. "We are, I hope," said Kennedy, "going to go in other areas where we can be first and which will bring more long-range benefits to mankind. But here we're behind."

On April 15 the air strikes preceding the Bay of Pigs invasion commenced; by the 19th Kennedy had decided against active support of the C.I.A.'s fiasco. He had inherited a military failure. The following day, this "depressed and lonely man" (Sorenson's phrase) wrote a memorandum to Lyndon Johnson—who had acquired special responsibility for space, and that day became Chairman of the Space Council—asking for "an overall survey of where we stand in space." He asked whether there was any space program "which promises dramatic results in which we could win?"

The Webb-McNamara Memo
Johnson's response was a memorandum from James Webb, the N.A.S.A. administrator, and Defense Secretary Robert S. McNamara. This memorandum, classified secret and even now not released to the public, was based on the first chapter of a Defense Department study of U.S. space activities which McNamara had commissioned earlier that year, and which had been drafted by Deputy Director of Defense John Rubel.

The historic presidential decision to go to the moon consisted in approving the lunar-landing program "exactly as it had been set out in the Webb-McNamara memorandum." The package included, in addition, the development of the Rover nuclear rocket and of communications and weather satellites.

That is one way of boiling down the story of the decision. On the basis of Logsdon's careful assembly of documents and interviews one could tell it many other ways. One could leave out the Bay of Pigs. One could make J.F.K. appear mightily original in his thinking. One could make him appear the helpless puppet (which Eisenhower refused to be) of von Braun, Lyndon Johnson, and the congressional aeronautics lobby. One could portray him as a simple Irishman upon the tail of whose coat a Russian had trod.

The only lasting interest in the circumstances of the May, 1961, decision arises out of the commonplace assertion that, if we can go to the moon, we can do many other things of similar magnitude: provide medical treatment for sick people who are poor; build pleasant homes which those of average income can afford; devise a cheap, efficient, comfortable intercity transportation system which does not fill the air with poison and the countryside with debris. Apollo was a multi-billion-dollar nonmilitary federal project which succeeded in its stated aims, within its allotted timescale and budget. Can such a thing be expected to happen in any sublunary field of action?

Logsdon, after much consideration, comes to the conclusion that four conditions are necessary for an Apollo-like decision to be made and carried out: the objective must be known to be technically feasible ("with a high degree of probability"); the objective must have been under debate long enough so that those in favor and opposed are known, and their political strengths can be taken accurately into consideration; some suitably traumatic episode must present itself—the "occasion for decision"—for no great thing can be done without the stimulation of a crisis; and there must be people at the top who can recognize the foregoing scenario and play their destined parts.

Put this way, it does not sound so unlikely. Which leads me to suspect that the first two-thirds of the book, the historical record, is of more value than the analysis which follows. Logsdon has done a considerable service in pulling together the elements of the histories of official U.S. space policy, of German-American rocket engineering and the obsessive aiming-for-the-stars that went with it, of congressional enthusiasm for extraterrestrial responsibilities, and finally of the months of Kennedy's greatest vulnerability. The factual part of the book leaves one ready to draw one's own conclusions.

Dardanelles of Space
Mine, for what they are worth, include the following: that we cannot hope for any useful Apollo-sized program in the

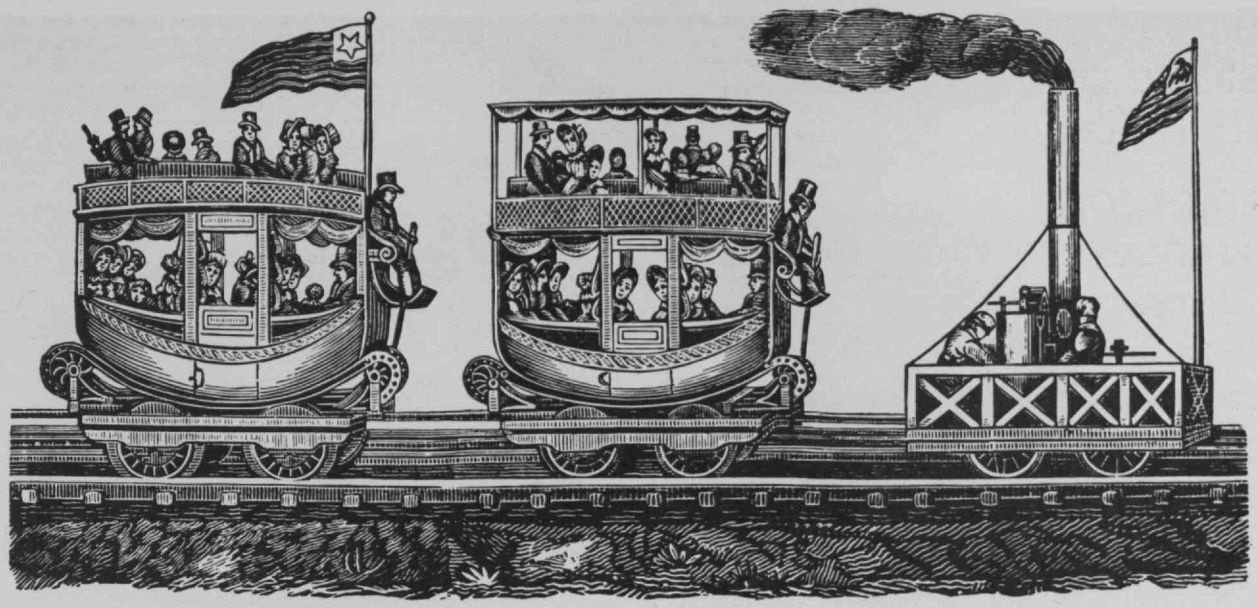
absence of any useful counterpart of the von Braun team, tirelessly bringing to perfection a thing that had not been asked for. And I suspect that public and congressional pressure for manned space exploration, by 1961, owed a great deal to the myth of military necessity: the "fact" (to quote the Lyndon Johnson of October, 1960) "that if any nation succeeds in securing control of outer space, it will have the capability of controlling the earth itself." In the same month President Kennedy had published a statement drafted by Senator Stuart Symington's assistant Edward Welsh, who later became Executive Secretary of the Space Council, putting it this way: "If the Soviets control space they can control Earth, as in past centuries the nation that controlled the seas has dominated the continents." There is no suggestion that Kennedy ever actually believed such stuff. On the other hand, I have met intelligent laymen who still do; it must have been driven very deep into the woodwork of the public mind. In 1959, we learn, the Air Force Director of Advanced Technology, in reference to the moon, said: "This outpost, under our control, would be the best possible guarantee that all of space will indeed be preserved for the peaceful purposes of man." This kind of science-fiction pseudo-strategy, noised about in the popular press, must have had some effect on the electorate. What that effect was, and how it influenced the President, seems to fall below Logsdon's notice.

Instead, Logsdon is at pains to construct a rational justification which might in principle have motivated Kennedy in May, 1961. Apollo was in the national interest, the tale runs, in the following sense of "national interest." The goal of foreign policy at the time was not mere territorial security (which had been achieved) but the protection of the American way of life and basic values. Kennedy is supposed to have believed that this way of life would be difficult to preserve if the country were surrounded on all sides by peoples who lived differently. And therefore, that as much of the world as possible should be persuaded to do things our way, so that we should not be tempted from the paths of righteousness by the continued example of any remaining breeds without the law. Others must imitate us, lest we should feel moved to imitate them. Because, in the words of Walt Rostow, "it is difficult to envisage the survival of a democratic American society as an island in a totalitarian sea," then it follows (in less than two pages of Logsdon) that the country's domestic goals have a lower priority than foreign ones, and that these latter include "an expansive American mission of spreading its way of life to all corners of the globe." Within this context, Apollo is to be understood as a kind of advertisement, "demonstrating the continued dynamism and power of American society through example."

The idea that the most powerful and influential nation in the world was driven to such a desperate quest of the bubble reputation, merely to preserve its citizens from the corrupting influence of the unconverted, is hardly credible. Smaller and weaker nations, certainly, find it increasingly difficult to prevent the encroachment of alien manners, but America has never had any trouble in this respect. Two centuries of trans-Atlantic traffic have left these states utterly unleavened by the faintest breath of European life. No influence even of Canada can be felt in Vermont. Over half a million aboriginal inhabitants, actually living on American soil, are detectable only as a source of cheap jewelry. America is, in a word, immune.

Well, this national-interest advertising theory of the Apollo decision is not upheld even by Logsdon's own excellent presentation of the facts, and I quote it mainly because it is entertaining. It appears rather that by 1961, given a successful Russian manned orbit, the decision to send men to the moon was almost unavoidable, whether reason was for it or against. It is, at any rate, a fascinating exercise to rerun the early months of that year with a Republican president, committed to defending and continuing the Eisenhower approach—that is, to taking the advice of his scientists on space, and, in response to Communist spectaculars, seeking "ways of affording perspective to our people." Faced with the Webb-McNamara plan (by some other name, of course), a myth-crazed populace and Congress, and a couple of overseas predicaments from which no glory could be squeezed, would he have laughed, like Ike? Or would he have taken the easy way out?

And can anything useful be made so easy?



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Increasing emphasis on the relevance of science to seeable problems breeds timidity and hesitancy at a time when courage and innovation are our special need

Edward E. David, Jr.
Science Adviser to the President

Toward New Initiatives

It is abundantly clear that problems of society and the public temper, which derives in part from them, are today having a major impact on science and technology, and it is now important that these issues be understood and their effects assayed.

Perhaps the most obvious of the several paradoxes and contradictions before the U.S. today derives from public interest in and concern for the degradation of the environment. Offshore drilling provides a major source of natural gas which is the cleanest combustible fuel; but there is ample evidence of environmental hazards inherent in recovering this fuel. It is easy to cite cases of pollution where everybody agrees something should be done, but issues of what, how, when, and who will pay seem to foreclose any action at all.

For many, the ultimate paradox is the conflict between the growth of the economy and the quality of life. But there is another dilemma more specifically applicable to the scientific community which is becoming a major concern, both inside and outside of government. This is commonly stated as a confrontation between mission-oriented or applied research on one hand and basic research on the other.

An Environment Fostering Timidity

There is little doubt that today's climate for basic research is quite different from that after World War II, when it could be accurately claimed that the results of basic research had saved the nation. The signs of the time were well reflected in Vannevar Bush's now classic report, *Science, the Endless Frontier.* In that atmosphere, almost anything could be undertaken under the name "research," and it received both financial and moral support. In subsequent years, the size of the research enterprise grew until today it represents an expenditure of about $10 billion per year including both industry and government funding.

In the past five years, however, there has been a growing dissatisfaction among the public and its representatives. There are several identifiable reasons for the disenchantment with free-wheeling research which has produced the now-familiar call for "relevance." The public and industry who have supported research in the past are saying, "We have immediate problems and research must solve them." Among scientists and engineers themselves, there is the feeling that the pressing problems of society should be of concern and should be reflected in the research programs. An even more restrictive opinion might be paraphrased, "We won't grub-stake you to climb that mountain just because it is there; prove to me there's something worthwhile at the top."

These trends are perhaps best exemplified by the so-called Mansfield Amendment, actually Section 204 of the 1970 Military Authorization Bill. It stated that "none of the funds authorized to be appropriated by this Act may be used to carry out any research project or study unless such project or study has a direct and apparent relationship to a specific military function or operation." This restriction on the Department of Defense has been in effect well over a year and its influence on research has been much discussed. The Department of Defense withdrew about $8 million of support as the result of the amendment — a very small fraction of its total research budget. However, the secondary effects of this amendment have gone a good deal further. Many contracting officers, in trying to carry out the intent of the Congress, have applied extremely strict criteria in determining whether research work did indeed bear a direct and apparent relationship to a specific military function. It seems clear that research work sponsored by the Department of Defense as a whole has been shifted markedly toward the goal of producing specific *ad hoc* results.

The tragic result of these trends is that new initiatives are questioned, not acted on. Indeed, attacks on science and technology have led to a timidity and hesitancy across a wide range of national activity.

The Irrelevance of Relevance

We often hear discussion of a conflict between "applied" and "basic" research, or "directed" and "nondirected" research. But I believe these distinctions do not describe the fundamental issue that we face today. The important distinction, as I see it, concerns research emanating from needs versus research which can produce new capabilities and new possibilities. This distinction does not concern the subject matter or motivation leading to the research. It does concern the style of the work — whether or not the work is done so that a landmark of knowledge or technique is laid down. Research tailored closely to a specific need is less likely to lead to such landmarks.

The problems of the environment, now so much in public view, lead often to needs research. That is, society has

a need for solution to certain problems. Money is put into work on these problems. The search for a cancer cure and low-pollution automobile engines are examples.

It is certainly true that research of this stripe can be productive. As H.L. Mencken has said, "Some problems are so difficult they can't be solved in a million years unless someone thinks about them for five minutes."

There are some particularly fascinating examples of needs research. One which tickles my fancy is the recent revelation that workers at the Bureau of Mines' Pittsburgh Energy Research Center have succeeded in converting urban refuse into low-sulphur fuel oil. This conversion takes place under pressure, using carbon monoxide and steam in addition to the waste. The process works on glass- and metal-free urban refuse, sewage sludge, and indeed any kind of cellulosic waste. Demonstrations so far have been on a laboratory scale, but the process appears so promising that a prototype pilot plant is being contemplated and could be in operation as early as 1972. The importance of this result is, of course, that it might help solve two problems simultaneously — namely, oil supply and solid waste disposal. The refuse-to-oil process yields about two barrels of oil for each ton of waste. The economics and large-scale use of the process are not yet proven, but it does illustrate that mission-oriented needs research can be tremendously productive.

"The Congress and the public need to take courage to allow new initiatives. They must encourage work toward new possibilities. . . . We need work with the style that we have learned over the years is successful — namely, work which lays down a landmark of accomplishment on which future accomplishment can be built. . . . We must all — in government and in industry — try to help people regain their courage and project the future without timidity . . ."

However, needs research, if interpreted too narrowly, has a tendency to be somewhat myopic. For example, Dr. Charles Townes describes in a now-famous article in *Science* magazine the events leading to the invention of the laser. He points out that it was difficult to obtain support from mission-oriented laboratories for work in microwave spectroscopy. There was no apparent importance of this field in terms of the missions of laboratories and agencies. Out of work which was supported as basic by the government and some basic research elements of industry came the concepts behind the laser — and eventually its implementation. The laser itself, of course, has promising applications in machine tools, communications, medicine, and other areas, but perhaps the most surprising application seems to be in the controlled-thermonuclear-reaction area. It may very well turn out that the commercial feasibility of such reactors will hinge upon high-power lasers. It seems doubtful that the laser would ever have been invented if left entirely to research directed toward new sources of power.

Generality and Unpredictability

Indeed, scientific and engineering research is constantly bringing the impossible into the realm of the possible. Ideas produce these new possibilities, and producing ideas cannot be scheduled. Guiding this process toward specific goals has often proved spectacularly unsuccessful.

What, then, about the problems of society that we all sense today? What about pollution, education, the ghettos, the cities, and all that? If technology cannot respond precisely to society's needs, are we destined to live forever with these ills? Certainly not. Few problems of the 1920's, 1930's, 1940's, and 1950's are still with us. Some were solved, some bypassed, and some merely

faded in importance. The world of the late 1960's and early 1970's is different and was produced by the process of advancing technology, which resulted from new possibilities opened by research. Old problems are gone and new problems have taken their places. The same thing will happen in the future.

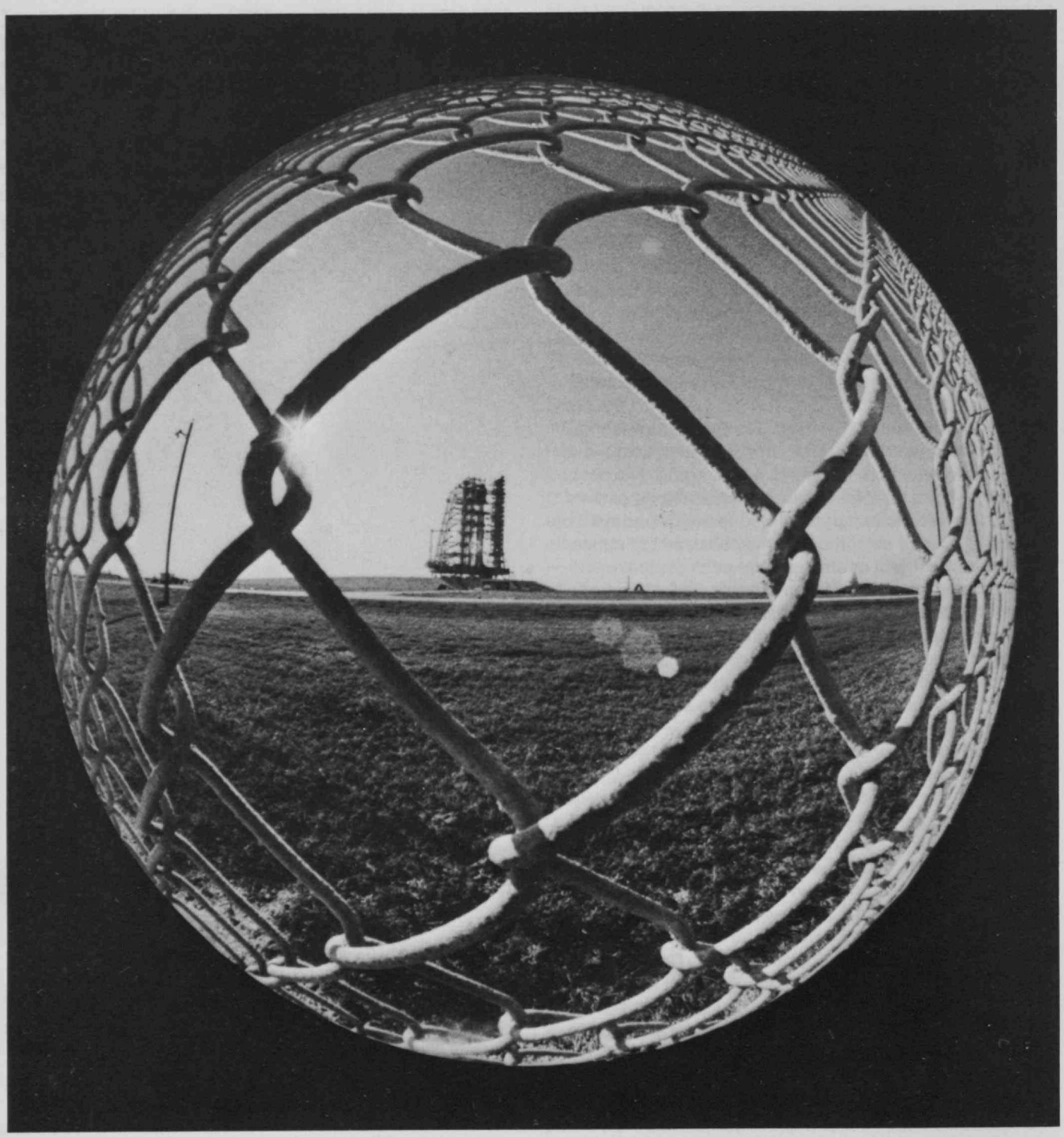
This is not to say that we should not try to solve today's problems or lessen their effects. But we must realize that perfect solutions are unlikely to be found. Rather, society will have opportunities to create totally new situations in which today's problems will be less important. However, this will come to pass only if we have a cadre of quality researchers producing new possibilities which are not widely foreseen. Thus, though I sympathize with relevance in research, I think that it can be carried too far. It can be highly counterproductive and wasteful.

Fortunately, the temper of the public and its representatives, which I mentioned earlier in connection with the Mansfield Amendment, seems to be changing. The new form of the Mansfield Amendment states: "None of the funds authorized to be appropriated to the Department of Defense by this or any other Act may be used to finance any research project or study unless such project or study has in the opinion of the Secretary of Defense a potential relationship to a military function or operation." This is quite a different statement from the previous one and leaves enough room for research on both needs and new possibilities. (It is fair to say, however, that the new wording has not been accepted with enthusiasm by Senator Mansfield himself or some others in Congress, and the previous wording may appear in the Military Appropriations Act.)

Discussions before the Daddario Committee of the House of Representatives by various senators and congressmen indicate a degree of sophistication and concern about research in science and engineering which goes far beyond what we would have witnessed even last year. Yet we are not out of the woods as far as timidity, hesitancy, and stodginess are concerned. The Congress and the public need to take courage to allow new initiatives. They must encourage work toward new possibilities. What counts here is not so much the subject of research but whether the work has the generality to produce the unexpected and the *tour-de-force*.

We need work with the style that we have learned over the years is successful — namely, work which lays down a landmark of accomplishment on which future accomplishment can be built. We know that it takes more courage to support work of this kind. We must all — in government and in industry — try to help people regain their courage and project the future confidently without timidity, sponsoring new initiatives in the quest for the new possibilities which will change the world into a better place.

When Edward E. David, Jr., was called to Washington late in 1970 to become President Nixon's Science Adviser, he was Executive Director for Research of the Communications Systems Division at Bell Telephone Laboratories, Inc. He first joined Bell Laboratories — where his professional contributions ranged through communications theory, speech and hearing, and computer science — in 1950, immediately following graduate work (S.M. '47, Sc.D. '50) at M.I.T. This article is adapted from an address by Dr. David during a conference for New England industrialists at M.I.T. on December 7, 1970.



Since the early 1950's, the increasing complexity of aerospace equipment, and the increasingly hazardous environments in which it has operated, have given rise to a new branch of engineering—system safety—permeating other branches. The new discipline is now entering civilian life

Charles O. Miller
Director, Bureau of Aviation Safety
National Transportation Safety Board

Why "System Safety"?

One of the impressive-sounding terms you are likely to hear bandied about these days is *system safety*. Does it mean no more than the safety of a system? Or is it a new sort of safety, different in kind from the classical safety of, say, the sword of Damocles?

In fact, the latter is rather nearer the truth, for *system safety* denotes a relatively new way of thinking and working, which emerged formally about seven or eight years ago in the aerospace industry and is now beginning to filter through into civilian life. There are two possible approaches to talking about it: one can try to improve on Webster's, or one can tell the story of how the new philosophy arose. I shall try to do both, in that order.

It can be argued that there is no such thing as "safety." Webster talks about freedom from harm or freedom from hazard. Now, who ever heard of that? Safety, as literally defined, is just an abstraction. But in the working world, safety usually has either a "condition" definition or an "activity" definition. It is either a certain state of existence, or it is something we do, intending to prevent harm to somebody (or some thing). In any case, we usually acquire a reasonable feeling for what safety means in our daily lives.

But for the word *system,* you can find many different interpretations. Some people understand the term only as in, say, physical weapons systems—the system comprises, perhaps, an airplane, facilities, personnel, and so forth to accomplish a mission. But it is a mistake to think that the concept of system safety applies only to concatenations of this kind. A much more generalized and, I think, practical approach can be arrived at by thinking as follows. Consider, say, the C-5 airplane. You can view this as an entire weapons system. But just as reasonably, you can isolate a certain part of the C-5—the flight-controls equipment—and call that a system. To one of the subcontractors to the flight-controls manufacturer, a power control unit is a complete system. And so on down to the last nut-and-bolt of the humblest production line worker. The point is that you begin by defining the limits of the system. You view it as something that has inputs and outputs. Knowing of a variety of safety measures, you then begin to see how some of them can be applied in this particular case.

To me, system safety is the integration of skills and resources *specifically organized so as to achieve safety over the entire life cycle of a system.* Albeit this implies some specialists working in safety, all personnel are part of the system-safety effort, and therein rests the power of a system-safety approach. This may all seem somewhat tautologous, but consider what happens when this philosophy is not followed. Suppose a serious catastrophe occurs in operational flight, and it is discovered that, years before, some designer thought this particular failure might conceivably happen, but he considered it was of low priority; later, a flier had worried a little about it in the test phase; but the people who might between them have made an informed judgment never talked to one another. It isn't as simple as handing over a product from the man who builds it to the man who operates it. Safety thinking must be organized-for at management level, bringing in all parties.

What does this require that management should know? A generalized professional safety task has been outlined by the American Society of Safety Engineers (in 1966) which, in general terms, is outstanding. But one must be more specific. The table on the next page is a list of 14 different specific safety tasks that one can present to management as requirements for work assignment. Failing such specificity (and the details of each item are a story unto themselves) the necessary resources will rarely be made available.

When all is said and done, what can really be said to be new or different or unique about system safety? The answer is not simple. However, within the frame of reference of the people operating in system safety today, there are three things which are relatively new ("relatively" meaning the last five years or so).

The first thing is adopting an interconnected (or "systems") approach, rather than just treating each component *in vacuo.* The second is looking at matters on a life-cycle basis, rather than attending only to a thing's ideal, initial performance. Every element of a structure has its own life cycle. And third, people are paying money specifically for our work, because customers are beginning to demand it.

Now how did we arrive at this point? A history of aerospace safety might begin with the 1926 Air Commerce Act, or with the laws that were passed in eighteenth-century France concerning balloon flights over the En-

What should general management know about safety? Here is one breakdown of the safety work which management must assign, and a sketch the author has used for many years "to show the interrelationship between the traditional man, machine, media factors of accident causation/prevention, together with time, cost and information constraints in the real world."

glish Channel, or for that matter with Daedalus's instructions to his son concerning the temperature-dependent behavior of adhesives. But it is really not until World War II—or rather, the years immediately following—that we find anything resembling modern concepts in aerospace safety.

Stateside Losses of World War II

Statistics show that far more aircraft, and indeed far more pilots, were lost in stateside operations during that war than ever were in combat. In 1943, for example, something like 5,000 aircraft were destroyed stateside, against 3,800 in the war proper. Similar ratios held for crewmen. Some statisticians tried to point out that these data really were not significant because, after all, more flying was done stateside than in combat. But the top generals, looking at the war in retrospect, saw that their ability to do a job (in this case combat) was being severely degraded by losses that were just pure accidents. Thus, people came to realize that safety means more than just concern for people—it also concerns the overall mission of an organization.

Then, shortly after World War II, in the period 1946 to 1948, people in military aviation were astonished by a new accident peak. They had thought that when the number of operations decreased things would calm down. On the contrary, the effects of minimal training of new personnel and the demobilization of experienced people produced a fantastic rise in the accident rate. Thus the war experience, plus this immediate postwar experience, resulted in a call to the technical community for help.

In 1948, William Stieglitz, who is still quite active in automotive as well as aviation safety, gave the landmark paper in what today has become known as system-safety engineering. "Safety," he said, "must be designed and built into airplanes just as are performance, stability, and structural integrity . . . a safety group must be just as important a part of a manufacturer's organization as stress, aerodynamics, weights, and so forth . . . safety [too] is a specialized subject." He made one interesting prediction: that accident prevention would have to be improved at a much accelerated rate if a rapid increase in the total number of accidents and fatalities was to be prevented. In other words, more than 20 years ago he described what is facing the civil aviation community today. The accident *rates* are low—

System Safety Tasks

◇ Develop and coordinate implementation of safety **plans** including program accident prevention, system safety engineering, accident/incident investigation, and disaster control plans.

◇ Assist in establishment of specific accident prevention **requirements.**

◇ Conduct or participate in **hazard analyses,** including the control process related thereto.

◇ Determine and/or review **emergency procedures.**

◇ Participate in design **reviews** and similar milestone events during product development and use.

◇ Maintain an accident/safety **information data center.**

◇ Effect **liaison** with other safety organizations.

◇ Provide recommendations for and/or conduct safety **research, study, and testing.**

◇ Implement **safety education, training, indoctrination, and motivation** programs.

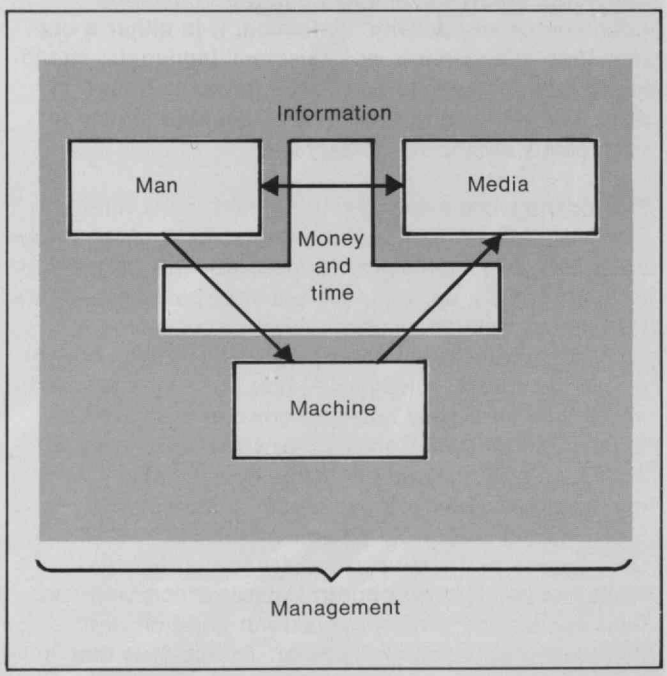
◇ Conduct or otherwise coordinate safety **surveys, audits, and inspections.**

◇ Participate in **group safety efforts** such as councils and standardization boards.

◇ Direct or otherwise participate in **accident/incident investigations.**

◇ **Follow up** all action resulting from accident/incident investigations.

◇ Provide **objective response** to safety inquiry as a staff advisor, in the confidential sense when appropriate.



very low—but projected 10 or 20 years into the future they combine with the rising numbers of aircraft to produce a totally unacceptable situation.

The same period saw the development of atomic energy and atomic weapons. This was a rather interesting event in safety because by edict, the numerical requirement was that we should have no accidents. As a result, certain "system-safety" techniques were developed.

The decade of the 1950's will go down in the safety business as reflecting the influence of the military. I am primarily speaking of the aviation, missiles, and space field; I leave it to the reader's judgment as to whether my remarks are more generally applicable. In the early 1950's, the Directorate of Flight Safety Research was formed at Norton Air Force Base; it was formed by General Victor E. Bertrandias, who had a unique philosophy of life: if a contractor would like to do business with the Air Force, then he should get some people involved in safety work at Norton. The theory that accidents can be prevented, though simple enough, was nevertheless revolutionary in those days. Shortly thereafter, joint Air Force-industry meetings began to be held. There have been nearly 60 of them over the years, where the lessons of experience have been exchanged on a highly informal basis.

The same General Bertrandias, together with the late Dean Carl Hancey, started the University of Southern California's safety activities. Since 1953 U.S.C. has graduated somewhere between 5,000 and 6,000 safety officers, civilian and military, from a course that gives them the equivalent of a year of college specifically in accident prevention.

The early 1950's also saw the formation of other military safety centers in aviation: by the Navy, a couple of years after the Air Force, and the Army, a couple of years after the Navy. Plots of accident rates of the Air Force, Navy, and Army, in that sequence, show similar time intervals between marked decreases in slope.

The Complexity Barrier

As far as I know, the first paper that had the term *system safety* in its title was written about this time. The term came into use when the "complexity barrier" raised its ugly head among the weapon systems. I vividly recall trying to understand a fully powered aircraft flight-control system and then trying to explain to some ingenuous pilot that he was connected from his stick to the airplane's elevators by a little slider valve which could move his elevator to its full throw by moving something like a quarter of an inch—an idea that the pilot didn't buy too easily, and perhaps with good reason.

When failures occurred in this kind of equipment, the hazards broke across us like a tidal wave. We were soon concerned not only with trying to develop weapons systems from a standpoint of schedule and cost, but also with how to keep them in the air without killing people faster than they were being trained. And, except for the benevolence of some managements, not too much of our thinking was finding its way into the actual programs at the early engineering phases.

The Navy then got into the act, in what I think is one of the key developments in this whole business. The Navy formed what they called the BuWeps Industry Material Reliability Board—the industry and customer getting together to try to solve common problems that showed up in bad accident records. In this case, the emphasis was on reliability and maintenance. This particular group in 1957 was significant, too, I think, because they recognized that you cannot deal only with the mainstream fields. They established working groups which eventually, over the years, recognized the so-called "ility" disciplines (maintainability, and so on, with safety included) that supplement the basic line management of a project.

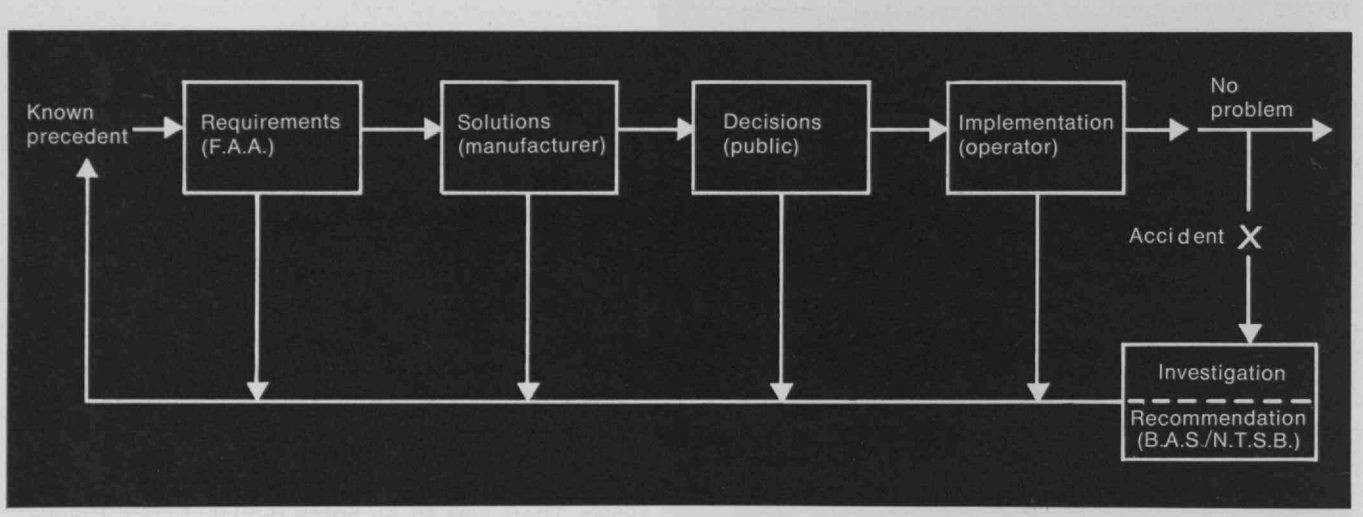
There were a few other significant events late in the 1950's. There was an Air Force B-50 that inadvertently dropped a special weapon over South Carolina. Although nothing detonated except a few pounds of conventional explosive and the event was cloaked in security for a long while, the case caused something of a stir in U.S.A.F. Command circles. Many years earlier, a "no-accidents" requirement had been written, but when the Air Force took a look at the systems aspect of this incident (how well the crews were trained, what combination of circumstances initiated the dropping of this store, and so on) what they found was pretty shocking. History will show, I think, that this incident set off quite a bit of systems analysis thinking to try to preclude a special weapon from detonating inadvertently.

Then, of course, there was Sputnik. If the 1950's showed the influence of the military, the 1960's were mainly influenced by the space race. I recall a conversation at Boeing in Seattle, in the very early design stages of the DynaSoar project. We were trying to decide what kind of an escape system this boost-glide vehicle should have. Amid all the pontificating, one of the experts suggested that "we get back to the fundamentals . . . that what we really need is a lifeboat approach . . . if you get in trouble just put a lifeboat over the side." But then came a very fundamental question. "If you put a lifeboat over the side, you escape; but where are you escaping to?"

This, to my mind, symbolized the change that took place in aerospace safety as we entered the space age. We

The overall life cycle of the civil aviation accident prevention system, showing the "closed-loop" character of a systems approach to safety.

One of the more recent techniques for approaching system-safety factors is the "fault tree," which represents the network of logical connections between failures and their causes and consequences. On the basis of such a fault tree (the example shown is simplified) computer simulation can establish at the design stage which are the important weak links.



encountered much more complex hazards. This was true of the environment (radiation or meteorite penetration), of the energy that might be stored in the new booster engine, and of the unprecedented degree of complexity over what had seemed already too complex a few years earlier in aviation. We all had to become accustomed to another order of magnitude of hazards, not only in manned vehicles, but also, perhaps even more so, in missiles.

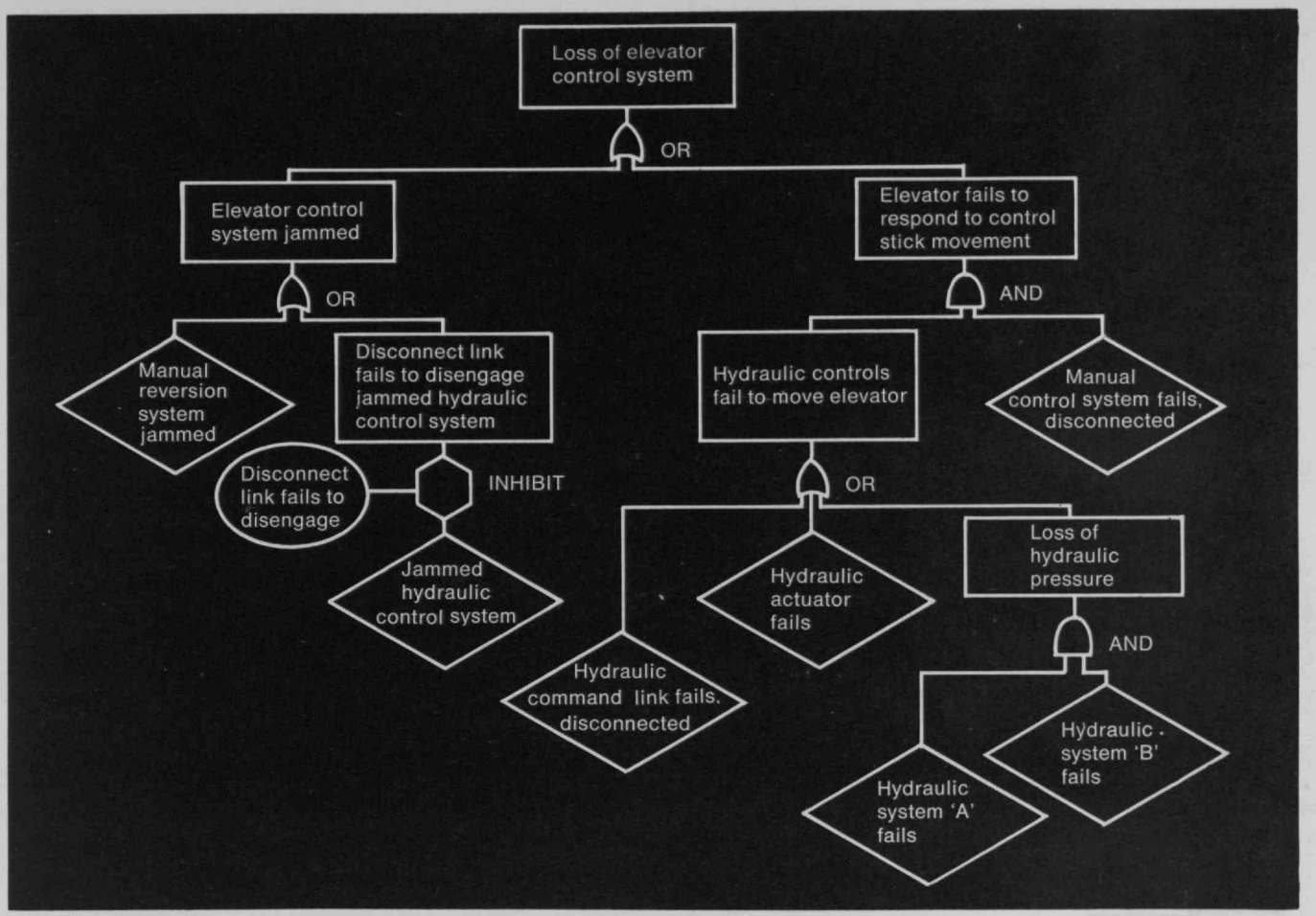
Arms without the Man

Indeed, it was in the missile field that the first real breakthrough by way of a well defined system-safety program actually occurred. It began there not only because the customer demanded it, but also because, in a missile, no human operator was on the spot to correct misbehavior, so it had to be designed safer than when he was present. We often look upon man as the cause of accidents, but in my humble opinion he is really the most powerful means of preventing an accident. The proof was the emergence of system-safety engineering into legitimacy in unmanned programs like Atlas and Minuteman.

The influence that emanated from the missile program can be traced to a Navy specification, MIL-S-23069, dated October 31, 1961, which specifically dictated "system life cycle" programs for accident prevention. Most people in the aerospace field today, though, rightfully give the U.S.A.F. Ballistic Systems Division (B.S.D.) the lion's share of the credit for requiring, in some formalized sense, a system-safety engineering program. This effort was outlined in B.S.D. Exhibits 62-41 in 1962.

From then on, other specifications came into being. The first one applied to all U.S.A.F. aerospace systems (MIL-S-38130); the Air Force instituted this one in the fall of 1963. Certain parts of the Navy had been pushing for this approach as hard as they possibly could, but while they were attempting to get the basis of this specification "through channels," a very active gentleman in the Air Force pushed it through their administrative mill and got it out. It appears that some of the Navy people then decided they didn't need such a measure, if the Air Force was taking care of it. It wasn't until three years later that MIL-S-38130, with an addendum, became a Department of Defense safety-engineering specification. The current version of what the Department of Defense feels should be the elements on the system-safety program is known as MIL-STD-882. Significantly, MIL-STD-882 goes beyond the engineering approach per se and includes principles of a total system safety program.

All this activity in the military and space fields began to infect other areas. For example, in 1965, the supersonic transport program was in the final competition phase between Lockheed and Boeing. During this time, the Federal Aviation Agency established a system-safety office and told the contractors to come up with a system-safety program. In addition, Mission Safety 70 was created at the federal level, affecting all government agencies. Although this was basically ground-safety initiated and oriented, it had the effect of



making people look around to see how many different safety branches—real or potential—they might have in a given organization. This was especially true in the Air Force, certainly true in other government agencies, and possibly true in many manufacturing organizations.

Next came the Apollo fire that killed three astronauts at Cape Kennedy. Until this time, N.A.S.A.'s safety program was fragmented at best. When the world spotlight focused on astronauts being killed by the simple ignition of some oxygen with some burnable materials, the event forced N.A.S.A. to consider the system aspects of safety, in a way that was probably unmatched by any single impact in any organization in our time.

Airliners, Railroads . . .

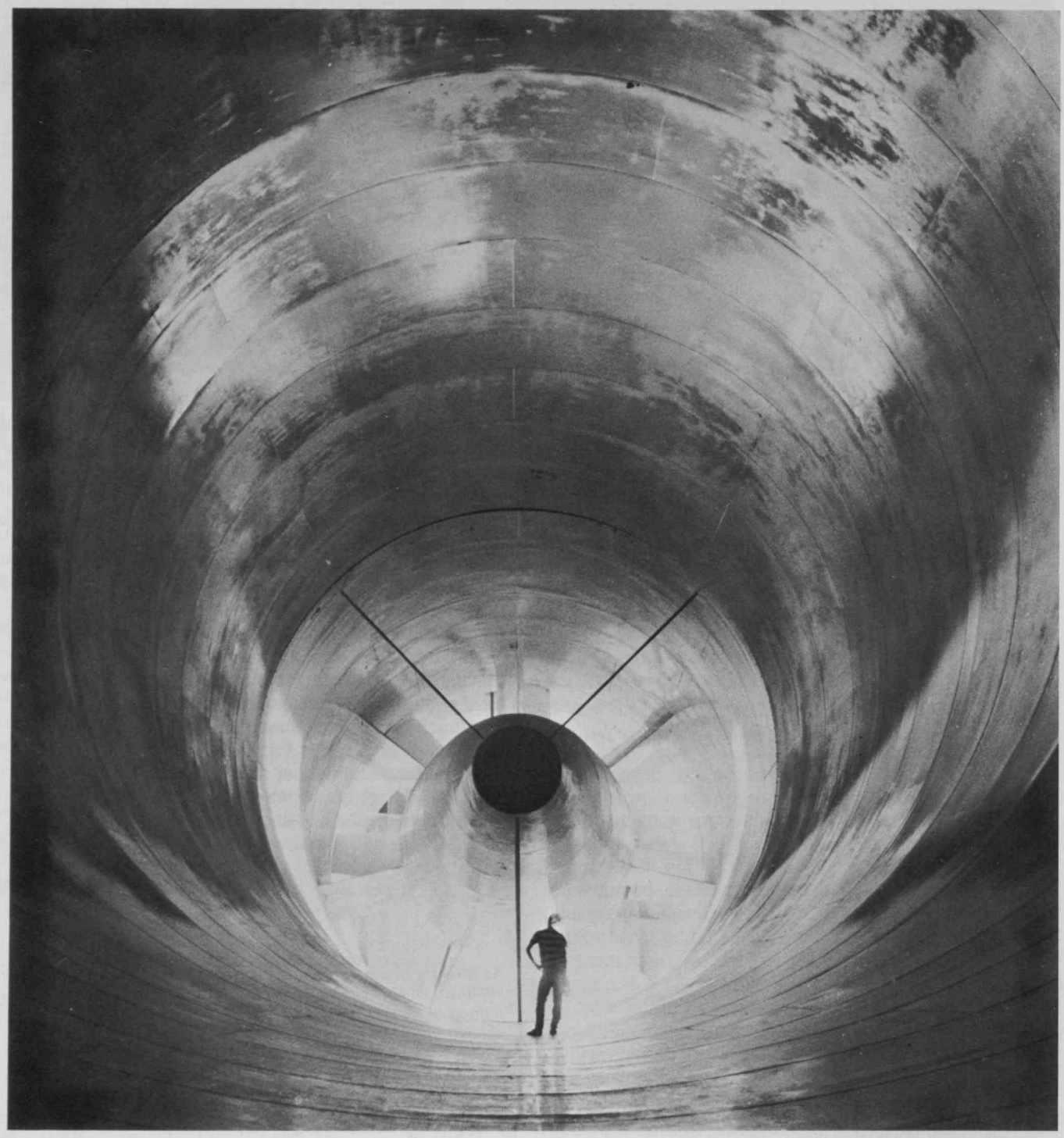
In the last year or two, there is reason to believe that the Air Transport Association (which is concerned with air carrier aviation) has been giving serious consideration to a self-regulating system-safety specification applicable to commercial manufacturers. In the same recent period the Navy, through its ships divisions, has taken a much more than casual interest in the system approach to safety. In 1968, Joseph J. O'Connell, first Chairman of the National Transportation Safety Board, asked the railroads why they were not taking some kind of a system-safety approach on their high-speed trains. Bob Currie and Jack Recht have introduced system thinking at the National Safety Council. Carl Clark has done the same for the products safety field.

So the major influences have been of various kinds. First of all, there is the effect of many, many agencies, government and nongovernment. There is the effect of a number of individuals. There is what I like to call the critical event syndrome (the Apollo 204 fire, the midair commercial aviation collision over New York, fires in New York's garment district, and the like.) Too often, we need a catastrophe to get corrective action under way.

In the last few years, safety engineering and safety thinking throughout the entire life cycle has acquired a recognizable philosophy. We have come to regard accident prevention as our *real* objective (although injury prevention is never far from the surface). We certainly have come to see accident investigation as just one (feedback) part of the whole prevention process, and not as an end to itself. And most important, all safety fields (industrial, nuclear, missile, flight, transportation, or whatever) are now a lot closer together—a lot more like a single discipline—than, say, five or ten years ago.

As Director of the Bureau of Aviation Safety (since August 1968), C. O. Miller is responsible for the investigation and reporting of all civil air accidents, and numerous related prevention measures. He holds a B.S. degree in aeronautical engineering from M.I.T., and a Master's in Aerospace Management from the University of Southern California, where he became Director of Research at the University's Institute of Aerospace Safety and Management. At one time he was a test pilot with the Chance Vought Corporation (now L.T.V.).

For reasons inherent in Canada's history and geography, the national government holds a dominant influence in Canadian technology. The National Research Council, the principal channel for the exercise of this influence, has had the advantage of great freedom and has used it to permit management of Canadian science by the scientists themselves. In the picture: the N.R.C.s' new $7 million, 30-foot low-speed wind tunnel at the National Aeronautical Establishment near Ottawa's Uplands Airport. (Photo: National Film Board)



Among western nations, Canada enjoys an immense endowment of natural resources. Yet their development by Canadian industry has been slow and dependent for the most part on foreign capital and direction. The new Canadian mood favors change but is still searching for the formula to achieve it

Leonard Bertin
Science Editor
University of Toronto

Science Policy in Canada

C. P. Snow has pointed out that "it is very difficult to have useful discussion on the goals of scientific policy without first reaching some common understanding of what ought to be the relationship between science and society, between the scientist and the politician." In this context, the fact that Canada still lacks a well-defined and widely accepted national goal provides one of the best explanations of why her leaders have been unable to formulate a clear policy for science and technology. But it is also true that Canadian science, with its strong traditional bias towards the "pure," has failed to demonstrate its relevance to, and its interest in, everyday affairs of government.

There are signs of change, however, and the promise that some of these deficiencies may soon be made good. Probably no area, except defense, has had closer scrutiny in the past few years than science. The establishment of the Science Council of Canada, a fact-finding and advisory body, was one constructive result. Another was the formation in January, 1970, of the Association of the Scientific, Engineering and Technological Community of Canada (S.C.I.T.E.C.) to provide a forum and support for science rather like the American Association for the Advancement of Science. A major stimulus has been the report of the mission of the Organization for Economic Cooperation and Development, making a national science policy study.

Huge, Rich, and Empty

Canada's potential for scientific development is unlimited. As the recent O.E.C.D. review points out, she is "a huge, rich, empty country." Her area is one of the largest in the world. She has snow-covered mountains to provide cheap hydroelectric power and to attract tourists, fertile prairies to grow grain, and magnificent forests that remain still to be properly exploited. In her rivers and lakes and muskeg she has the largest resources of fresh water available to man, while her coasts are superb vacation lands and offer well-sheltered harbors superior to any other on the continent.
Already the world's largest exporter of such basic materials of modern industry as iron ore, aluminum, nickel, newsprint, pulp, and timber, Canada possesses the largest known deposits of potash fertilizer and immense reserves of petroleum, almost untouched, in the Athabasca tarsands and in the Arctic. She also has quantities of sulfur and gas coal, impressive deposits of uranium, and a broad range of other nonferrous metals.

John Deutsch, former chairman of the Economic Council of Canada, pointed out in an address during the Centennial that Canada has come a long way in its first 100 years as a nation. She is now one of the world's industrial leaders. On a per capita basis, her productivity is exceeded only by that of the United States. Her citizens, as a result, are among those best endowed with the fruits of modern technology.

Canada's economy has grown twice as fast as those of Western Europe and Britain during the past century, at a rate surpassed only by Japan. And Dr. Deutsch foresees even greater growth in coming decades, should the environment continue to favor the expansion of foreign trade and the easy movement of people.

He is certain that Canada will be extraordinarily favored in the years ahead with two essential ingredients to growth—human and physical resources. Because of postwar changes in the birth rate, the working population will increase by at least 50 per cent by the early 1980's. This rate will exceed by a large margin that of any other industrial country in the world, he prophesied, so that the expected growth in Canada's labor force between 1965 and 1980 will be larger than those of Britain, Germany, and Italy combined.

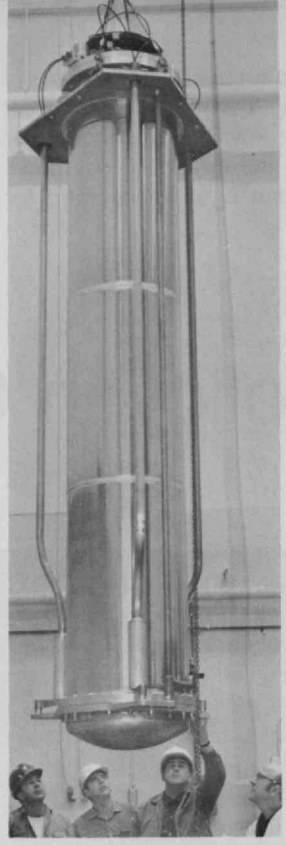
"If we can achieve some further progress in the reduction of artificial barriers," Deutsch added, "and if we succeed in avoiding a crisis on the international exchanges, Canada's foreign trade could, over the next 15 years, more than double and could reach a volume not far from three times the present level."

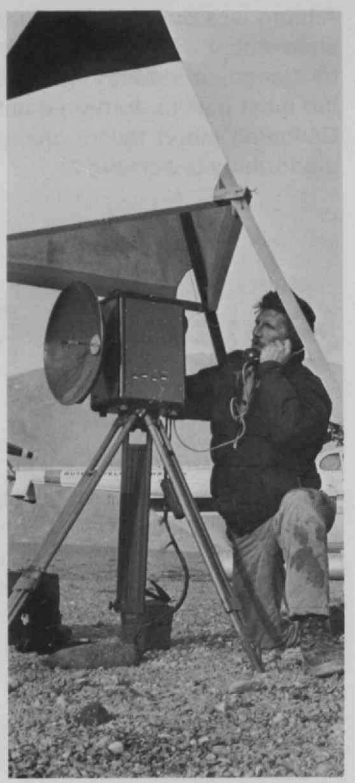
But the prospect brings with it new problems and new responsibilities. Developments foreseen for the years ahead will entail more specialization and more intensive industrialization in every sphere. In this immense country, more than 90 per cent of the population will still want to live in less than 1 per cent of the available land space—and rapid urbanization has already brought housing shortages and pollution, human alienation and urban blight. Political and social institutions are being outpaced in Canada, as elsewhere, by technological change.

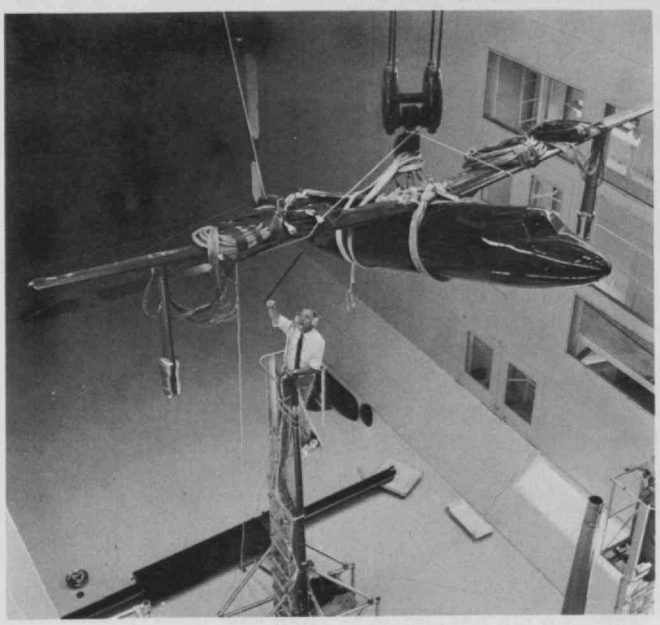
Science Policy and the National Research Council

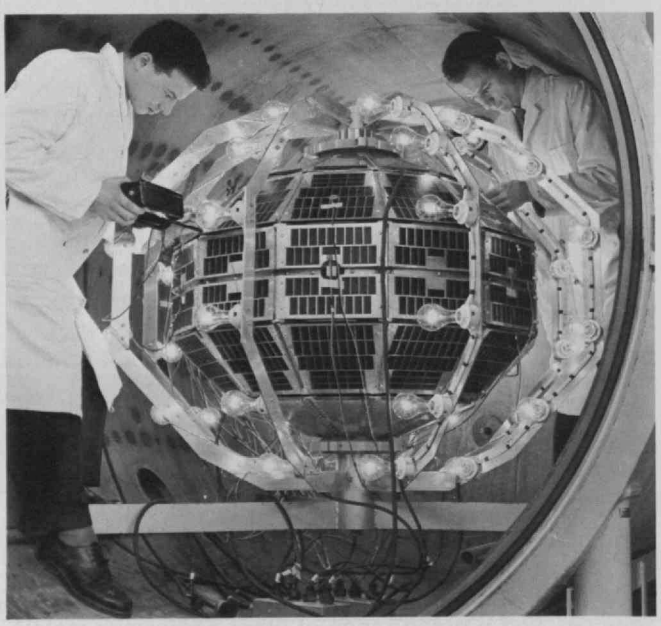
Canada, in fact, has all the problems of the big country without a big population to cope with them. Her 21

A kaleidoscope of Canadian science (top to bottom, left to right): an outlying camp of the Canadian Polar Continental Shelf Project on the Arctic Ocean; plankton sampling nets used to study pollution and its effects in Lake Ontario; a one-fifth-scale model of the Canadian-planned de Havilland DHC-7 V/STOL aircraft in the test section of N.R.C.'s new wind tunnel (see page 34); the Canadian-built minimal-energy "Slowpoke" reactor prepared for installation in the Environmental Sciences and Engineering Center of the University of Toronto; a tellurometer electronic distance measurer used on a field survey in the arctic islands; nuclear research at the University of Toronto; and Canada's polar-orbital satellite Alouette I which made Canada the third nation to have a self-made artificial satellite in flight. (Photos: National Film Board and University of Toronto)









millions are polarized by two widely different and sometimes antagonistic cultures and, largely for reasons of climate, are concentrated in a narrow belt more than 2,500 miles long on her common frontier with the U.S.

To the south, the U.S. offers investment capital and vast potential markets for goods and especially for raw materials. However, the pattern of investment and of industrial development has been such that a large proportion of Canadian companies are now subsidiaries or associates of foreign industry and are controlled by foreign nationals subject to their own laws. Furthermore, much of the research and development done for these companies is in the hands of parent firms, located mainly in the United States or in the United Kingdom. When outside help is needed, parent companies rarely enlist the aid of Canadian universities or research institutes. Nor have Canadian universities done much until recently to solicit contracts for mission-oriented research.

The O.E.C.D. report points out that over a period of time, these factors have made it necessary that central government become a dominant influence in Canadian science. The process was a slow one. Science began to contribute to the country's development around the end of the nineteenth century, and some of the national laboratories, especially those concerned with agriculture, fisheries, and mineral resources, gradually became large and sophisticated institutions. Similarly, the provincial research councils were designed to serve diverse and specialized local needs. Those of British Columbia and the maritime provinces concentrated chiefly on forestry and marine sciences; those of the prairie provinces on the development of agriculture and mineral resources. Ontario's research council specialized in industrial problems.

Development followed no plan until the First World War created an immediate need for expansion and for a system of national priorities. To meet wartime needs, the National Research Council was formed. It soon became the backbone of Canadian science, and, almost by default, the formulator of what national policy there was.

The National Research Council had a privileged and unusual position in one sense: it was given great freedom from the start in spending the national funds allotted to it. Also—and this had great significance for later development—it was managed from the outset by the scientists themselves. It began with a modest allotment of $100,000 a year in the early 1920's; by 1967-68 it handled more than $100 million.

The initial function of the N.R.C., after the First World War, was to coordinate and promote scientific and industrial research in Canada. In fact there was precious little to coordinate. The Council therefore began to nurture the growth of a viable scientific community by supporting research in the universities. Much later, it created its own laboratories for both fundamental and applied research. These organizations, especially the chemistry laboratories, moved steadily towards an excellence rare in government institutions.

Unlike research in most other industrialized countries, however, and largely because of Canada's dependence on Britain in matters of defense, there was little stimulus for basic and applied science in several fields related to military needs. In fact, as the threat of World War II materialized, Canada found herself without a single research establishment connected with the armed forces. The one nondepartmental national research laboratory, that of the N.R.C. in Ottawa, had a total staff of only 300 employees and an annual budget of less than $1 million.

World War II had dramatic effects both on science and technology in Canada. While Canadians made major contributions to the development of new explosives, radar, the proximity fuse, defenses against chemical and bacteriological warfare, and many other fields, their most important gain was a new feeling of self-confidence.

Continuing the Argument: Basic vs. Applied

Once the war was over, however, old traditions soon reasserted themselves. Exploitation became a dirty word, and younger scientists were encouraged to be proud of being unconcerned with the applications or implications of their discoveries. Even when discoveries were made in Canadian universities that could be exploited, they were often identified, expanded, and exploited by foreign firms. Local industries remained ignorant of or indifferent to them. So it was that the visiting O.E.C.D. team of examiners found that, even where relations existed at all between universities and industry, their superficial nature was "one of the most regrettable features of the Canadian scientific scene."

"Wherever we went, all over the country," they reported, "we heard complaints from the academics about the naivete of industrialists and their failure to appreciate research, and from industrialists about the excessive academicism of the universities." The situation, they suggested, is no worse than exists in many European countries, but it is dramatized by proximity to the U.S., where the picture is quite otherwise. The concentration of fundamental research has been explained as a result of N.R.C.'s preoccupation with scientific excellence and of the abnormally high proportion of applied research undertaken by other federal institutions. It has been suggested that the whole country would benefit if federal institutions would contract out much of the research they conduct themselves to universities and industry.

Annual budgets describe the present position eloquently. In terms of gross research and development expenditure, and using mid-1960 figures, Canada ranks sixth among O.E.C.D. countries, behind the United States, the United Kingdom, Germany, France, and Japan, all of whom, of course, have populations exceeding her own. The total of $630 million amounts to only 3 per cent of the United States' expenditure and 30 per cent of the United Kingdom's.

The real disparities show up when the budget is examined in detail. It is then seen, for example, that the $215 million spent on applied research represents only

5¼ per cent of the United States' expenditure in the same field, while $194 million spent on development is an insignificant 1.6 per cent of the United States figure of $4 billion.

Both C. M. Drury, Chairman of the Privy Council Committee on Scientific and Industrial Research and President of the Treasury Board, and Dr. Omond Solandt, Chairman of the Science Council of Canada, have stated that industrial research and development must be increased. They agree that a greater proportion of future financial resources should be put into product development, for a more immediate return, than into pure research. They have also said that, given the cost of competing economically with the United States, every effort should be made to invest Canada's resources in areas where she has, or can hope to have, a competitive position in world markets.

With Inadequate Guidance from Scientists

But those trying to interest industry in larger, subsidized research programs and those concerned with allocating government funds must face also a lack of unanimity in the scientific community itself.

Prime Minister Pierre Trudeau cited this dilemma a year ago when he explained the government's decision to cancel plans for the 200-inch Queen Elizabeth telescope, to be built high in the Rocky Mountains, and for the $200 million intense neutron generator, the most contentious of all scientific proposals to date.

Scientific and industrial research, he asserted, must be a top priority for public investment. He acknowledged that the percentage of the national wealth that has been directed to "this vital field" in the past has been small in comparison with other industrialized countries, but emphasized that "even in this area, we must be increasingly selective in the programs we support." But, he went on, the government "found that there was considerable controversy within the scientific and industrial community about the priority which should be accorded this project [the generator] in relation to other programs in the same field—about its potential value to Canadian industry and about its long term effects on Canadian scientific activity. . . . After carefully weighing these opinions and estimates, we decided that, in view of the overall demands on the national treasury, we could not allocate the required funds under present conditions."

Priorities and Philosophies Need Defining

In Canada, as in the U.S., science policy decisions are complicated by the need to balance the sometimes conflicting problems of the development—and conservation—of natural resources, of environmental pollution, and of inadequate transport and communications. Energy is of little use unless it exists in, or can be delivered to, places where it is needed. One of the major factors behind the recent development of new hydroelectric resources in areas like Labrador and the northern shores of the St. Lawrence River has been the successful transmission of very high voltages. More and more in the future, however, the load will fall on nuclear energy, and there, sooner or later, major decisions will need to be made about basic philosophies.

The issue here is that Canada has stuck tenaciously to natural uranium reactors, moderated by unpressurized heavy water and cooled by either heavy or light water running through pressurized tubes surrounding each fuel channel. The 3,000-megawatt power station that is being built currently at Pickering, 15 miles from metropolitan Toronto, will be one of the largest in the world. If all goes well with this station, Canada will derive great benefit from a strengthened nuclear industry.

For reasons not based on its nuclear aspects, however, the C.A.N.D.U. prototype of this station on the shores of Lake Huron is years behind schedule and its performance has been disappointing. While defects have not invalidated the nuclear concepts used, many have argued—and continue to argue—that Canada should have diversified its effort. They also question the wisdom of investing hundreds of millions of dollars on plants to produce heavy water to support a program that remains still to prove itself. Particularly, they urge that some effort should have gone into the parallel development of reactors that would, like many in the United States, employ light water as moderator and enriched uranium as fuel.

Scientists of Atomic Energy of Canada, Ltd., the Crown company responsible for nuclear power development, insist that they are on the winning horse. They also complain that cancellation of the intense neutron generator, their one really imaginative project, has robbed Canadian science of a tremendously invigorating challenge. The generator, the realization of which depended on the successful achievement of big forward steps in many contributing technologies including high voltage generation, envisioned bombardment of a liquid metal target by a high-flux particle accelerator to produce a flux of neutrons several orders of magnitude higher than is available from conventional reactors. Its cancellation produced in the nuclear field a feeling of exasperation and disappointment akin to that in the field of aviation when the Diefenbaker government killed the Avro Arrow interceptor program in the late 1950's.

The need to find something equally challenging but of more obvious and immediate benefit to the economy than the neutron generator is paramount but apparently beyond the imagination of those who presently hold the nation's purse strings. Certainly, science and technology have come up with none of their own, except, perhaps, that of a Canadian communications satellite. The problem is not purely financial, of course. There is the need to preserve a proper balance of scientific and technological effort. There is also the matter of manpower.

Nor is the problem Canada's alone. Apart from Russia and the U.S., no single country in the world is capable of building an accelerator in the 100-billion-electron-volt range where much of high-energy physics is now focussed. Neither France nor Britain felt able to under-

take the construction of a supersonic jetliner on their own. Even the United States is finding the exploration of space a costly business. And, as science and technology entertain thoughts of international proportions, their dependence on government becomes all the more obvious.

Improving the Administration of Science

To fit government for a growing role in guiding and operating science and technology, the O.E.C.D. examiners made a number of proposals. Most of them echo suggestions already widely made by scientists and engineers. The O.E.C.D. board suggested, for example, that there be a Minister (but not a Ministry) of Science, a senior member of the Cabinet without departmental responsibility. He would derive his authority directly from the Prime Minister. The examiners did not think that the minister responsible for science should be, as at present, the President of the Treasury Board, because of the obvious conflict of interest.

Mr. Drury, understandably, has opposed this view. A Minister of Science, he says, would be placed in "a rather difficult and unenviable position. He would have no department to serve and might well be considered a mere lobbyist for the scientific community." He went on: "When it came to deciding between projects affecting various departments, I think the ministers of the departments concerned would resent a third minister speaking as a high priest of science and rendering an opinion, supposedly stamped with Science's Good Housekeeping Seal of Approval."

A second proposal was that there be a Cabinet committee, presided over by the Minister of Science, to ensure that science policy decisions penetrated the whole departmental structure. Its members would include ministers responsible for all departments with major scientific programs, including defense, as well as the President of the Treasury Board. Such a committee would be akin to, but far more active than, the existing Privy Council Committee for Scientific and Industrial Research.

A proposal for the creation of a Science Secretariat to inform the government on research matters has already been implemented. The further proposal that there be a Science Policy Council, consisting of "independent scientists and engineers from the universities and industry, nominated by the Minister of Science and reporting to him," with a full-time chairman, and that this be "a functioning part of the machinery of government," could be taken as approval of the present Science Council. In fact, however, it would represent a more powerful body than the present one, whose role is primarily to outline options and draw attention to situations. The difference becomes apparent as the O.E.C.D. examiners propose that the Minister of Science might himself be the Chairman of this Council or that the duties of the Council and Secretariat chairmen might be combined. This latter might well be unpopular since, as they themselves point out, "we have noted Canadian distaste at the idea of a science czar."

The final mechanism suggested by the examiners was a Government Research Board "to institute permanent mechanisms of innovation, to ensure the sufficiently quick emergence of new missions and the running down of old ones." Given that fundamental research in Canadian universities has achieved great strength in recent years, they did not feel that it was now appropriate for major programs of pure research to continue in government laboratories. They suggested, instead, that "it might be worth considering whether the government laboratories concerned could be converted into an institute linked to the two universities in Ottawa."

Since much of the applied research carried on by the National Research Council is of continuing relevance and can only be undertaken in government laboratories, a further solution proposed was that a Canadian National Laboratories Agency might be established to undertake general service and mission-oriented research other than that presently undertaken in various departments.

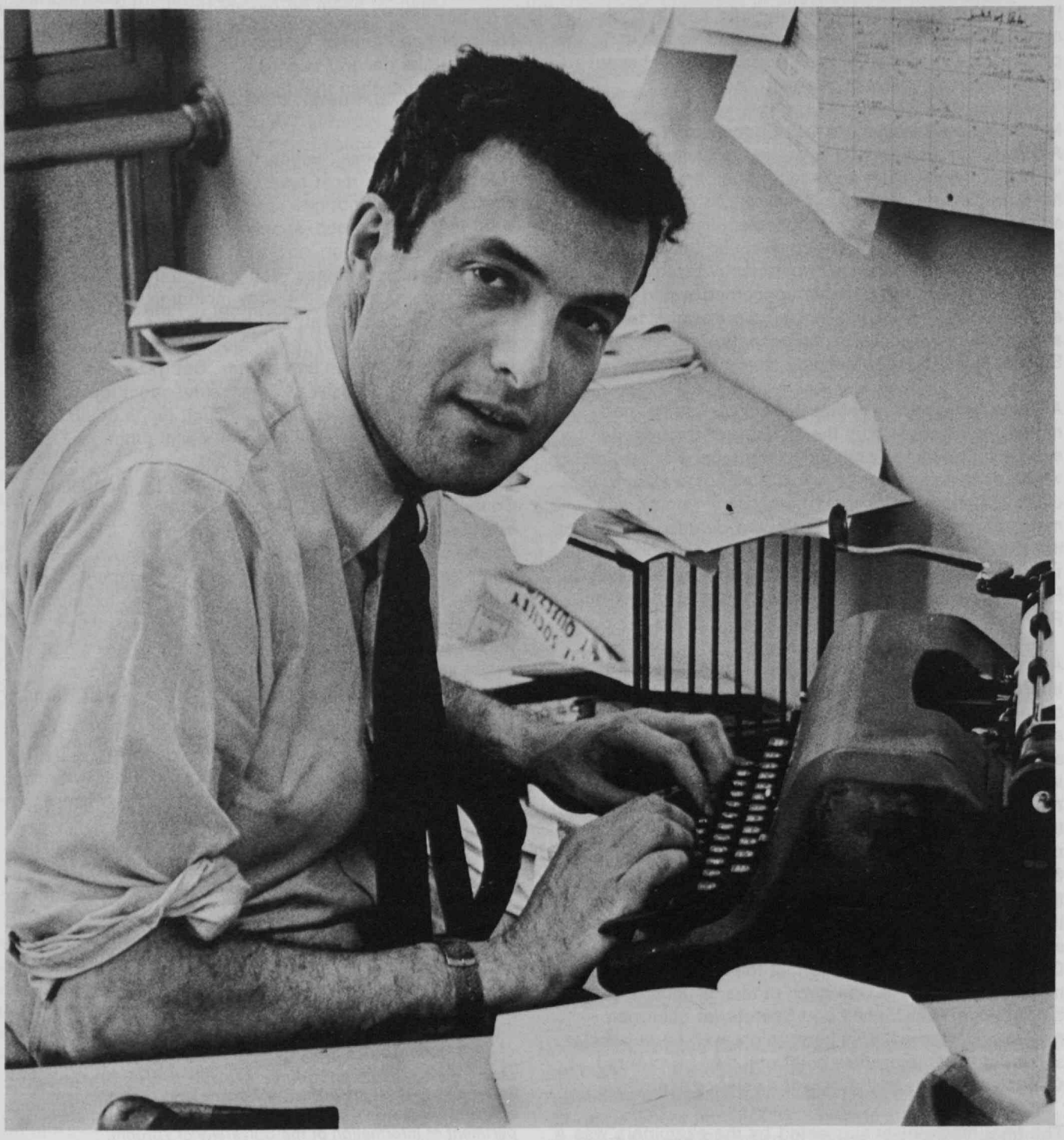
This latter proposal, which threatens to dissect the N.R.C., Canada's most revered scientific institution, is controversial but not new. The same idea was put forward by a study group, sponsored by the Science Council, to report on government support of research in Canadian universities. If it were implemented, then the N.R.C.—or some new body including, perhaps, the medical, behavioral, and social sciences—would be left with the still-major responsibility of channeling research funds to the universities. But if Canada ever does acquire a Minister of Science, he might feel that the control and disbursement of such funds could be one of his most powerful and influential functions.

The problem of policy, as described by the Economic Council of Canada in its fifth annual review, may sound overly simple. "What is basically involved," it stated, "is the application of a growing stock of knowledge to the satisfaction of human wants. . . . When we discuss a scientific policy for Canada, we should be examining alternative courses of action which Canada might follow, partly directed towards augmenting our stock of available knowledge and partly to using it to an increasing degree to the satisfaction of Canadian wants." In basic analysis, it is in striking a fair balance between these two objectives that Canada has experienced most difficulty.

Suggested Readings

Target 2067: Canada's Second Century, Leonard Bertin. Toronto, Macmillan of Canada, 1968.

Leonard Bertin, former science correspondent of the Daily Telegraph and Morning Post *of London and then science editor of the* Toronto Star, *is now science editor of the Department of Information of the University of Toronto.*



The "crisis" of U.S. science is very real—and its effects may bring American universities face to face with bankruptcy before federal action can be evoked. But the effects may also awaken scientists to a more rational view of their purposes and priorities

Daniel S. Greenberg
Editor, *Science and Government Report*

The New Politics of Science

Looking back over the past three years, perhaps the most striking aspect of the science-government relationship is to be found in the decline of the scientific community's influence in Washington. That influence was, in many respects, a unique configuration in the affairs of state. Unlike other competitors for power and influence in Washington, the scientists arrived in the capital mainly by invitation—the invitation of troubled politicians who needed guidance in the application of new and mysterious technologies. Once there, they diligently attended to their advisory duties, but at the same time they also saw to it that the federal government looked after the financial needs of their profession. There was nothing nefarious or illicit in this process. But it was, at the very least, unusual in the sense that the scientists were able to ride a crest of cold war concern, and if they did not stampede their political superiors into voting funds, they most assuredly did take advantage of the fact that the politicians were obliged to depend for advice upon those very same people who stood to benefit from acceptance of the advice.

It is naive to assume that big science can be aloof from the hard-sell tactics that have become standard in virtually every other phase of American life. A quest for millions from the U.S. Treasury—whether for highways, bombers, or chemistry—arouses, perhaps inevitably, given the cacophonous nature of the U.S. public process, the question of how to make the most attractive case.

Throughout the first two decades of the postwar period, the quest for funds for research was almost invariably successful, if not from one agency then from another, with the result that ever-increasing funds became the natural order of things in the scientific community. A whole generation of scientists grew up knowing nothing but this situation in the financial affairs of their profession. Any reasonably bright science student could look forward to government-paid graduate education and modest living expenses. (With very few exceptions there could be no such expectations on the part of his fellows in the humanities, the social sciences, or other professions.) Upon receiving his degree, he could look forward to a postdoctoral fellowship, again courtesy of the U.S. government, or participation in a government-financed research project. With a bit of experience behind him, and perhaps his name listed among the authors of a scientific paper or two, he could apply to one of the federal agencies for a research project of his own. A favorable response would elevate him to the role of principal investigator, and then he could look around for bright young men to join his team as part of their own progress up the scientific ladder.

Meanwhile, the din of construction was to be heard throughout the community. Great laboratories, federally financed in whole or in part, were rising across the land to house the swarms of people who were flowing into the scientific professions. The conference circuit thrived; travel became part of the scientific life, so much so that one would often hear scientists complain of it. Such was the ambience for a young man in a scientific career after World War II.

What we are concerned with here is why the system began to malfunction during the Johnson administration and finally to break down at many points in the Nixon administration. Why, for example, do we find Philip Handler, President of the National Academy of Sciences, declaring in 1970: "Our national apparatus for the conduct of research is not yet dismantled, but it is falling into shambles. Morale of the scientific community is lower than at any time since World War II. New fields of scientific exploration clamor for attention and for funding." Why, in 1969 and 1970, did the National Academy of Sciences and the New York Academy of Sciences hold grave convocations on what was deemed to be a financial crisis in science? What went wrong?

Competition for the Federal Dollar

In seeking an answer, we might, for a beginning, entertain the possibility that after 20 years of ever growing affluence, the scientific community simply had lost touch with economic reality and that, despite its financial ups and downs, it nevertheless remained relatively well off. This interpretation conceives of the "crisis" as a matter of perception rather than harsh economic reality. Such was the interpretation I often encountered among foreign scientists from 1968 to 1970, when I was European correspondent for *Science.* The view there was that science in America had become encumbered by a great deal of fat; that fiscal short rations, though personally painful for many, would be beneficial for the health of the scientific community as a whole; but that even in a state of recession, American scientists still lead the world in commanding resources for most fields of research. From this perspective, the lamentations of

" . . . if higher education is to avoid bankruptcy, federal funds in substantial sums will have to be made available for general educational costs. The nation is not going to resume the subterfuge of meeting these costs under the heading of research —with all the deleterious effects that apparently flow inevitably from such a process."

American scientists, heartfelt as they might be in origin, were grounds for puzzlement or amusement rather than concern.

I think there is some validity to that reaction. When French President Pompidou toured the United States in 1970, he visited the two-mile-long Stanford Linear Accelerator, which at a construction cost of $114 million and an annual operating cost of $28 million, all from the federal government, might be viewed as tangible evidence of a substantial American commitment to the support of fundamental research. Nevertheless, the director informed his visitor, "I would be telling less than the truth if I said that basic science in the United States is in excellent condition—it is not." And he went on to declare that "the situation in Europe is far healthier," which possibly puzzled M. Pompidou, who had just presided over a savage pruning of the French national research budget. Furthermore, at that very moment, the nations of Europe remained deadlocked over plans for the construction of an advanced nuclear accelerator (Britain had dropped out of the venture in 1968 for reasons of economy), while the United States was well along in building the world's most powerful machine of that type. What are we to make of a penchant for crying poverty in the face of what can at least be considered relative affluence?

We are not dealing with greed; rather, as I. I. Rabi, the Nobel laureate physicist, pointed out in a lecture in 1963, "There is something like a Parkinson's Law that scientific activity will grow to meet any set budget and find it to be grossly inadequate." The leadership of the scientific community can never be satisfied. If, for example, fellowships are available for x number of science students, why not x plus y? If all high-level talent is supported for study and research, why not alter the criteria to include lesser talent? If the atmosphere of Venus is being analyzed, at great expense, why not simultaneously a venture to analyze the atmospheres of Mars and Jupiter? If 40 ships are probing the depths of the ocean, though only 20 were at such work a few years before, why not expand to 80? Neither selfishness nor greed is at work here. The fact is that scientists believe in science, and—more important—the world abounds with excruciatingly interesting and unanswered questions; and scientists have a passion to dig into them.

It is tempting, possibly because it is easy, to formulate

what went wrong as follows: starting in 1965 money was in short supply because of the demands of Vietnam and the domestic urban crisis; as a result, there was less money for many activities that depend on the federal government, science among them; from this followed the "crisis" in the financing of research. Unfortunately, this is more a description than an analysis; it tells us a good deal about what happened, but little about why.

A Cost-Benefit Analysis

Acknowledging that the "why's" of recent public events are often formidably difficult to identify, I believe that science lost financial favor principally because the statesmen of science lost credibility with the political leaders who had long accepted them on faith. The causes of this loss were numerous, but high among them was that pleas for the further expansion of science bore little relation to any plausible assessment of the value of research in the life of the nation. Furthermore, too many tricks had been pulled in past attempts to gain support; too often had alleged Soviet competition turned out to be nonexistent or insignificant; too often had great economic or social value been claimed for science when, in fact, it is impossible to say with any certainty just what it is that pure science contributes to society. Britain, for example, has been agonizing for years over the fact that though she invests heavily in basic research and training of fundamental scientists, her industrial growth has been negligible. Japan, at least until recently, was an international laggard in basic research, but the pace of her economic growth is legendary.

There are some explanations for these embarrassing affronts to the ideology that depicts pure science as an essential ingredient of national wealth and well being. But, after 20 years, tales of the genesis of the atom bomb and antibiotics no longer served to open the government coffers. As Philip Abelson, Editor of *Science,* has pungently remarked, "It's been a long time since science pulled a rabbit out of the hat."

In consequence of all these factors, I believe, a lot of people simply stopped believing that science was as important as the scientists said it was. This does not mean, I emphasize, that any responsible person arrived at the conclusion that science was unimportant. Rather, the general feeling was that it was directed at the wrong objectives, had become swollen, and was too disengaged from the public financial system that paid its bills.

"Is there such a thing as 'socially responsible' science? At one time, most inhabitants of the pure science community would probably have doubted this. But in recent years, more and more scientists have come to question the comfortable notion that science is ethically neutral and that the scientist must necessarily be absolved of responsibility for what is done with his work."

Nevertheless, though the wails of the scientific community tend to obscure the facts, it is worth noting that through the worst of it, the federal government has been regularly providing several billion dollars a year for the conduct of basic research and associated activities. What has happened, however, is that it is no longer persuaded, or persuadable, that the financing of science must grow at a steady, fairly rapid pace, and that if it does not, the consequences for the nation will be unfortunate. For example, an official of the Office of Management and Budget remarked in 1970 that the Dutch, having completed a radio telescope unmatched by any facility in the United States, were hiring American radio astronomers—a situation which, in the past, would easily have served as a spur to a concerted U.S. effort to catch up. American astronomers, he said, regarded the situation as deplorable. The Office of Management and Budget, he pointed out, did not.

Research as Special Privilege

When Winston Churchill lost a bid for reelection toward the end of World War II, his wife remarked that his defeat might actually be a blessing in disguise. Churchill is said to have replied that if that were so it was very effectively disguised. I recall this incident because I would at least like to toy with the idea that the difficulties encountered by the scientific community over the past several years might not be without therapeutic effect. It is, of course, easy for a spectator to take a long view of the travail of others. But I hope that an attempt at attaining some perspective will not be taken for heartlessness. Unemployment, the thwarting or delay of long-held career plans, and the failure to explore important scientific opportunities are not slight matters. Nevertheless, the phenomenally rapid postwar growth of science in the United States did, as a matter of fact, take place in a fashion that produced a variety of extremely undesirable side effects.

In my view, public authorities, particularly the U.S. Congress, bear more responsibility for this than does the scientific community. The worst that can be said about the scientists, I believe, is that they vigorously exploited their opportunities. But it was the politicians who for a long time left the door to the candy store unguarded; it was the politicians who gave science a privileged access to public funds without first insisting upon an examination of the implications for the rest of society. For example, rather than face up to the inadequacies of finance for higher education, Congress—perhaps absent-mindedly, perhaps in collusion—permitted "research" to become the vehicle for pouring federal assistance into the university system. And, not surprisingly, research, with its own mores, values, and rewards, tended to overwhelm the educational function of many institutions. The fault is not with research, which, despite the clamorings of many know-nothings, deserves a central place in higher education. Rather, the fault is with a financial system that provided ample money for research and relatively little for other activities.

In this circumstance, research inevitably responded to its opportunities. Failure to have done so would not have accrued to the benefit of other segments of higher education. The opportunities were not transferable. Eventually, however, the affluence of research and the relative penury of many of these other segments became insupportable. Students rebelled at grant-laden absentee professors, business managers and trustees rebelled at demands for a bit of "matching" money to qualify for large amounts of federal research money, and the public—through Congress, ironically as it may seem—began to question the value it was receiving from these publicly supported aristocrats.

Toward a Sense of True Reality

Unfortunately, the public process in the United States rarely prefers a direct route to the solution of a problem. Roundabout is the traditional way, and often it is a long and painful one. But, without being pollyannish, it seems to me that the financial crisis in research, and the attendant crisis that it has brought to the treasuries of many of our universities, is at last producing some sense of reality, and a recognition of the need for remedies. The extraordinary apathy of the Nixon administration, plus its inclination to use higher education as a whipping boy for political purposes, very likely postpones the day these remedies will be applied. But if higher education is to avoid bankruptcy—to put it as bluntly as that—federal funds in substantial sums will have to be made available for general educational costs. The nation is not going to resume the subterfuge of meeting these costs under the heading of research—with all the deleterious effects that apparently flow inevitably from such a process. So, if we can carry on somehow or other until this recognition takes life in the form of congressional appropriations, then, perhaps, the present crisis can be looked back upon as a "blessing in disguise."

Along these lines, I would also suggest that there is a good deal of merit in the much-maligned congressional action to force the Defense Department out of its quarter-century-old role as a major source of finance for academic research. Most of the money has undoubtedly been "clean" in the sense that it comes without strings and that the results, or virtually all of them, may be openly published. But it is naive to assume that the Defense Department has simply been a source of charity for the conduct of research. Those

who accept its role and performance as manager of the nation's lethal power are, of course, free to do business with it. But when they do so, they should recognize that the Pentagon's research managers are charged with the task of enhancing that power, and that their interest in academic science is extremely purposeful. Furthermore, I put little stock in the argument that academic participation in research of interest to the military is a source of liberalizing influence and rationality in Defense Department affairs. The record to date suggests that the Pentagon is quite capable of winnowing the scientists' technical expertise from their political preferences. Along with many other fictions that have worn thin in recent years, it would be desirable to tear apart the one that depicts the Defense Department as a benign, disinterested patron of science.

It is also worth questioning whether the long-neglected National Science Foundation can ever fulfill its attractive potential while the Pentagon is on hand to provide substantial funds for academic science. Congress and the Executive tend to look at lump sums in allocating federal resources, and when the Defense Department budget for basic research in universities is of a large order, resistance to expanding the N.S.F. budget rises commensurately.

How "Neutral" Can Science Be?

Finally, it is important to note that the scientific community has of late been engaging in a good deal of soul searching about values and priorities in science. No easy task here, but it is a necessary one, for the public is rightly concerned about many afflictions that have arisen from supposedly beneficial technologies, and it is even more concerned about the likelihood that even greater afflictions might come as side effects of further scientific developments that will eventually take technological form.

Is there such a thing as "socially responsible" science? At one time, most inhabitants of the pure science community would probably have doubted this. But in recent years, more and more scientists have come to question the comfortable notion that science is ethically neutral and that the scientist must necessarily be absolved of responsibility for what is done with his work. I see the problem, but I must confess that I have yet to see the answer. Neurological research, for example, can lead to desirable therapeutic techniques, but it can also assist the development of nerve gas. Examples of this sort abound, and, as far as I know, no satisfactory system has yet been proposed for filtering evil from useful possibilities in the acquisition of basic knowledge.

Nevertheless, while no perfect remedy for this dilemma exists, it is reassuring to observe that an increasing number of scientists—particularly young scientists—are profoundly troubled by their profession's capacity for serving evil purposes. Many of them have voluntarily taken on the task of attempting to inform the public of the social and political implications of new scientific and technological developments. Some have even dropped out of research careers to pursue this objective. In effect, they are trying to bring the adversary process into the affairs of science and technology, and this is all to the good. For the closed-door decision process, though it served the narrow interests of science and technology through much of the postwar period, can be blamed for a good deal of the "crisis" that now confronts these important segments of national life. The process of dragging them out into public view—so that all interested citizens may be aware of their social and political implications, as well as their financial underpinnings—is inevitably a painful one, especially for those who long benefited from the old ways of doing business. But in the long run, we may all be better off for it.

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"We will forever be dealing with programs which cannot be once-and-for-all solutions to the problems they are designed to attack. We are living with a loss of the stable state. As a consequence, virtually no established institution feels adequate to the problems it now confronts." (Photo: Richard M. Koolish)

Why do social problems persist despite massive social and technological efforts to achieve solutions? Because changing problems render answers obsolete before they can be applied. Our solutions must instead be self-transforming learning systems

Donald A. Schon
President
Organization for Social and Technical Innovation, Inc.

Implementing Programs of Social and Technological Change

During the past ten years, we in the United States have been guilty of a substantial mismanagement of our intellectual resources for social and technological innovation. We have spent intellectual energy on technological invention and research, on the development of new social policy, and on the critique of existing social policy, whereas the issues before us have been centered around our incompetence to carry out any programs of change at all.

The programs to which we have committed ourselves—for example, those based on problems of poverty, crime, inadequate health care, or poor housing—have clearly failed to achieve significant change. Even over the last 20 years, to take one instance, each successive housing program has responded to the failure of the preceding. Urban renewal in the 1950's, 221d-3 in the 1960's, even current efforts at "turn-key" housing have been, each in its turn, attempts to compensate for the failure of public housing interpreted in the 1930's as a kind of center-city fortress for low-income people.

There are many ways to rationalize this record. Perhaps we simply had the wrong ideas; if our policies had been better founded, they would have been more successful. Perhaps we never adequately committed ourselves; because our investments in these programs never reached critical mass, we really have no way of saying whether the programs were sensible or not. But a more fundamental criticism will serve us better. The fact of the matter is that we are simply unable to bring broad programs of social change into effect. We do not understand the process, although we have myths about it, and our failure to understand it prejudices our present efforts with respect to such ideas in good currency as pollution and environmental control, guaranteed annual income, and administrative decentralization of social programs.

My disillusionment with our understanding of directed change dates to my own tenure in government, when over a three-year period I found myself participating in four programs involving policy change in science and technology.

The Civilian Industrial Technology Program argued that certain lagging industries, notably machine tools, building, and textiles, suffer from lack of research. The program urged federal support of research during a period in which the textile industry experienced serious threats from imports. But soon, as the textile industry began to profit from the effects of the Vietnam war, the pressure for federal support through research disappeared.

In 1962, we were all aware of a scientific and technical manpower shortage. Under the pressure of the rising demands of the Defense Department and the incipient demands of N.A.S.A. research and development programs, we set up a commission to deal with the problem. During the tenure of the commission, however, the rate of growth of research and development began to level off; we heard rumors of scientists and engineers walking the street in Los Angeles and Long Island. But at the end of its tenure, the commission nevertheless completed a report certifying the existence of a scientific and technical manpower shortage. Three years later came the Automation Commission, based on anxiety over the unemployment rate (then approximately 6 per cent) and especially on anxiety about technological unemployment. But during the work of the Automation Commission, the unemployment rate moved back toward 4 per cent, and the Bureau of Labor Statistics discovered that labor productivity had been increasing for the last 20 years at roughly 2½ per cent a year. The effects of technological unemployment were simply not detectable. And by the time the Automation Commission had finished its work, having produced a number of interesting documents, the cry of technological unemployment was no longer heard in the land.

These events led me to feel skeptical about the quality of ideas in good currency concerning the technological problems on which we should be working. I sensed a law to this effect: an idea that has come into good currency is no longer appropriate to its situation. There follows the corollary that ideas in good currency, on the basis of which one may be granted money for research, are almost never ideas pertinent to the problems on which one has to work. This leads to an interesting and familiar game. The contractor pretends he is working on the problem for which his money was granted while in fact he may be at work on a very different problem; meanwhile, the funding agency tries to keep the research faithful to the original proposal which is no longer appropriate to the problem as it now appears.

What kind of problem really lies behind our difficulties in understanding processes and implementing programs

of broad-ranging social change? I argue that the problem has two major characteristics: it is basically a question of social learning and the design of learning systems; and it is a question in which social and technological issues are tightly interwoven.

Contending with the Absence of Stability

We will forever be dealing with programs which cannot be once-and-for-all solutions to the problems they are designed to attack. We are living with a loss of the stable state. As a consequence, virtually no established institution feels adequate to the problems it now confronts.

If we look at federal agencies as a kind of organizational map, for example, each element of which corresponds to some problem, the problems tend constantly to shift out from under the map; indeed, it is possible to look at federal agencies as a series of memorials to old problems.

The practical consequence of the loss of the stable state is that we must see any programmatic solution to a problem as a learning system capable of shifting over time; no solution can be effective if it carries with it an organizational, institutional or programmatic definition pertinent only to the state of affairs at the time the program was invented.

Let me introduce the second issue—the interweaving of technological and social issues—by paraphrasing an anecdote from Elting Morison's book, *Men, Machines, and Modern Times*. He described there the introduction into the U.S. Navy of continuous-aim firing—a method of keeping guns trained on an enemy ship when both your ship and the enemy's are moving up and down and proceeding in different directions at the same time. The Navy's standard method employed a very heavy set of gears and a highly trained crew with a kind of football coach/naval captain behind the crew who gave it directions; although there was a gunsight, nobody dared put his eye to it because of the recoil of the gun. A young naval officer, sensing the inefficiency of the existing operation, elaborated on a new method which took advantage of the inertial movement of the ship; he simplified the gearing procedure and isolated the sight from the recoil so that it was possible for the operator to keep his eye on the sight and move the gears at the same time. He tested his system and was able to effect a remarkable increase in accuracy. He then wrote to the Navy headquarters with the aim of having his device officially adopted throughout the fleet, and the Navy wrote back that it was not interested. But the young officer had the persistence characteristic of technological innovators, and he finally persuaded the Navy to test his method for continuous-aim firing. The test consisted in strapping the device to a solid block in the Navy Yard in Washington; but, deprived of the inertial movement of the ship, the device failed, proving scientifically that continuous-aim firing was infeasible. The young officer was not deterred. Finally he reached President Theodore Roosevelt directly, and the President forced the device down the Navy's throat. Under these conditions the Navy accepted it and achieved a remarkable increase in accuracy in all theaters. Elting Morison points out that the Navy sensibly tried to protect the social system of the ship from a technology which was in fact destructive of it. By introducing continuous-aim firing, the officer threatened a specialized, highly trained team, replacing it with an operation in which, in effect, any recruit could serve.

The example is characteristic of social systems, whether a Navy ship, industrial firm, or community. The social system contains a social structure, a technology, and a theory. The social structure, reflected in formal and informal organization charts, is the set of roles and relations among individual members. The theory consists of the views held within the social system of what it is there for, how it operates, what should be its environment, and what is its future. Both reflect and, in turn, influence the prevailing technology of the system. These concepts all hang together; they cannot be broken apart. Any change in one produces change in the others. The consequence is that the system as a whole has the property of resistance to change. I would not call this property inertia—a metaphor drawn from physics, the tendency of objects to remain in their existing condition unless a contrary force is exerted on them. The resistance to change exhibited by social systems is much more nearly a form of dynamic conservation—that is to say, a tendency to fight to remain the same.

Every social system or organization has what I would characterize as a technological plenum: there is never an absence of technology or a vacuum into which new technology might move; there is always an existing technology and a social system tied to the existing technology. That social system will fight to preserve itself, and it will resist any change in technology which threatens it.

Efforts at technological innovation and social learning, then, have two features to them. First, the systems we are trying to affect—be it through housing, pollution, or transportation—are dynamically conservative. Efforts at change must have political power and leverage built into their fabric. Indeed, most significant change in our society in the last 30 years has been effected through forms of insurgency and invasion. But, in spite of the dynamic conservatism of established institutions, the *situations* in which these institutions function are inherently unstable. Therefore, the program that presents a solution cannot be a steady-state pro-

gram; it must always be a shifting one, and the principal problem of design is the design of learning systems, or systems able to transform their own behavior over time.

Contending with the Mythology of Change

Even if we develop practical understanding adequate to these characteristics of social innovation, there remains a massive obstacle. It is the rational mythology built into programs of change, particularly into those involving governmental initiative. This mythology has several elements.

We tend to insist, to begin with, that a given program represents a once-and-for-all solution to a problem. We act as though there were a one-to-one correspondence between the problem and its solution.

We believe in the notion of public experiment. The concept of experiment suggests that you can hold all variables constant except one and change the one to observe the effects of that change on the rest of the system. But in the situations in which we want to effect social learning, we are never able to identify all of the variables, we never have to do with a manageable number of variables, and we cannot change one variable without changing the others. There is, therefore, no possible experiment, in the scientific sense of that term.

The rational mythology also presumes that it is possible to evaluate what has been done and to learn from evaluation. In a prevailing model of evaluation, a third party provides an outside assessment of the work of an organization and feeds its conclusions for implementation to some authority within the hierarchy of the organization. But evaluations are seldom implemented. When they are read, they are often found to be inappropriate to the next situation. Political considerations emerge which are powerful enough to override the conclusions of the evaluation and so to govern the formation of the next program.

A third element of the rational mythology is the notion that in programs of social reform it is possible to move from a pilot program to a large-scale program. But there is great difficulty about starting small and going big. If the pilot fails, we are not by any means assured that it failed because it was a bad idea; and if it succeeds, we are by no means assured that if we scale it up the plan will operate effectively.

Sometimes this is because successful pilot programs depend upon individuals, whose magic is necessarily lost to all units of the expanded program. For example, the Labor Department found the Opportunities Industrial Council directed by Leon Sullivan in Philadelphia to be a great success in training underprivileged people for jobs; accordingly, the Department extended the program on a national basis, where its success is very much in doubt. Why? Because Sullivan was no longer associated with it? Because the Labor Department never did understand what in fact made the program work in Philadelphia?

Conversely, a pilot program may fail not because the pilot is wrong but because it is simply not at a proper scale. In the housing field, for example, it is often argued that an on-site factory can be successful if it can be assured of serving the construction of at least 1,000 units a year within transportation radius; if there are less than 1,000 units the factory may prove to be uneconomical not because it is a bad factory or a bad concept but because the scale is too small. But an industrialized housing operation in a city must have the support of craft labor unions, and in order to provide guaranteed annual wages for craft unions the factory must function at the rate of 10,000 units; a program operating below that scale will fail to win the union's cooperation. If a large firm is to invest substantially in building technology, there must be in prospect as many as 30,000 units a year; if the program is below that, it may fail not because it is a bad program but because it did not offer enough units to provide a profit potential attractive enough to stimulate the required capital investment.

Designing Self-Transforming Solutions

In pointing out the shortcomings of the rational mythology, I do not intend to be depressing. If we cannot *know* about social reform as the rational myth requires, then perhaps we need to think both about knowledge and about programs of social reform in a different way.

We must think of *programs* as learning systems, capable of transforming themselves to respond to the situations in which they function. Certain themes are critically important to programs as learning systems. One is the theme of networks and network manage-

. . . the systems we are trying to affect—be it through housing, pollution, or transportation—are dynamically conservative. . . . But the situations in which these institutions function are inherently unstable. Therefore, the program that represents a solution cannot be a steady-state program; it must always be a shifting one, and the principal problem of design is the design of learning systems, or systems capable of transforming their own behavior over time." (Photo: Ewing Galloway)

ment. If the organizational map for a given problem is inappropriate to the problem, then a solution must be achieved by pulling together fragments of various organizations, and the result then takes the form of the management of a complex institutional network. Under such conditions, network management becomes one of the principal features of the effort. If the organizational map is in improper relationship to the problem, if no single institution or organization can do the job, the brokerage role becomes central; people who operate in the spaces between organizational units become critical. Shadow systems—and the staging of shadow systems—become critical.

Consider, for example, a New York county which we will call Spread City, an area whose development has been based on the technology of the automobile. Its population density is relatively low. It is a jurisdictional jungle with many governmental units—health districts, housing districts, industrial districts, labor districts, etc.—overlapping in a variety of ways.

Fifty years ago, Spread City consisted of many small communities with almost no interconnections. At the present time these communities link to one another in a variety of ways, but there is no central business district and nothing that looks like a city. Nevertheless, it is possible to foresee from present patterns of growth that within 15 to 20 years Spread City will look like a major metropolitan area.

Among the issues presently confronting Spread City, transportation looms large. There are a number of enclaves of poor people living in Spread City who are cut off from services and jobs by inadequate transportation. In fact, it turns out that the cost of transportation to and from work, for most poor people in the area, is exactly the difference between welfare and the existing level wage in most industries. Clearly, by 1990 Spread City will have a structure appropriate to the development of a mass transit system based on a massive investment in transportation technology.

But the question today is this: What approach to the present problems of transportation in Spread City can lead to the development of a master plan for transportation in the county and promote large-scale investment toward that plan? No politically oriented response to that question can today be successful. But it is possible to devise a theory of gap-filling transportation solutions, each one of limited life—consisting of cabs, jitneys, and *ad hoc* bus routes—some supported by transit systems and some by service agencies and business firms within the county. If that set of gap-filling, *ad hoc* transportation systems is also conceived as a kind of shadow system, it can be used to plan the form and the routes that large-scale transportation systems in Spread City must later take. That is to say, we can treat the pattern people adopt for *ad hoc* gap-filling transportation as an inquiry into the form that should be taken by the massive transportation systems which Spread City will eventually require. No set of origin-destination studies will tell us effectively what the demand will eventually be for the large-scale massive transportation; but an incremental system which consists of a set of short-range solutions, tied to a monitoring of people's behavior in relation to those solutions, may do so.

A shadow transportation system, conceived as an inquiry into transportation systems requirements, illustrates the concept of a public program as a learning system. Here the distinctions between research, program development, and pilot program cannot be sharply made. Monitoring and evaluation are built integrally into a system which can transform itself over time. Such an approach to the design and implementation of social programs begins to respond to the problems of program implementation that we now face in every area of social and technological reform.

Before forming the Organization for Social and Technical Innovation, Donald A. Schon was Head of the New Products Group at Arthur D. Little, Inc., and previously Head of the Institute of Applied Technology at the U.S. Bureau of Standards. This article is adapted from his presentation at the Eastern Regional Conference on the Application of Science and Technology to Public Programs held in April, 1970, at M.I.T. under sponsorship of the National Science Foundation, M.I.T., the N.A.S.A. Electronics Research Center, the New England Regional Commission, the New England Governors' Conference, the New England Economic Research Foundation, and the states of Connecticut, Rhode Island, Massachusetts, Maine, New Hampshire, Vermont, New York, and Pennsylvania.

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Trend of Affairs

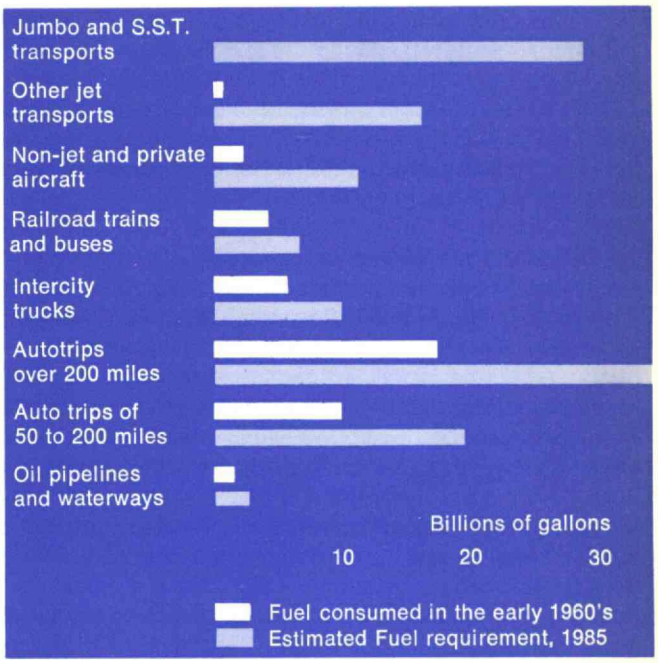
Transport Efficiency

After a literature search (including publications of the Sierra Club) and some personal experiments, Professor Richard A. Rice of the Carnegie-Mellon University Transportation Research Center concludes that a man walking at 4 m.p.h. uses about 0.1 horsepower and the same man riding a bicycle at 10 mi./h. uses something less than 0.15 h.p. Scaling these figures up through a long chain of energy units, Professor Rice figures that a man with a bicycle, given the energy in one gallon of gasoline, would eventually obtain some 75 gross ton miles of transportation. A two-ton automobile averaging 20 m.p.g. is doing only half as well.

This comparison of transport efficiency is only one of several score in Professor Rice's summary for the American Society of Mechanical Engineers' 1970 annual meeting. He shows, for example, that on a gross-ton-miles-per-gallon basis, the 100,000-ton supertanker is by far man's most efficient form of bulk transportation, at 1,330 ton miles per gallon. Next is a 200-car freight train, averaging 625.

When it comes to moving people, a 10-car double-decker suburban train wins the sweepstakes, providing 200 passenger-miles per gallon of fuel. Nearly as efficient (150 p.m.p.g.) is the old-style Hudson River paddlewheel steamboat—which is in many respects, including efficiency, a far cry from the *Queen Elizabeth II* whose figure is only 7.5 p.m.p.g. The self-contained "Buddliners" rate high (133 p.m.p.g.); so do buses (over 120 p.m.p.g., depending on design). At the bottom end of the scale are automobiles (around 30 p.m.p.g.), jet aircraft (the 707 at 21 p.m.p.g., the 747 at 22 p.m.p.g.), and intercity Pullman trains (18 p.m.p.g.). All of these last are excelled by a proposed helium-filled dirigible (44 p.m.p.g.).

Still lower: the S.S.T., according to its present specifications, at 13.6 p.m.p.g. When fully scheduled, according to present planning, a single S.S.T. aircraft will consume 80 million gallons of fuel a year. The result, says Professor Rice, can only be trouble: "Continued quantum enlargement of air travel systems yielding only 20 to 30 p.m.p.g. (let alone the S.S.T. at 10 to 15 p.m.p.g.) will so increase total petroleum use . . . as to certainly cause early review of this present trend."



The U.S. now uses just over half its petroleum consumption each year for transportation. By 1985 the amount needed for transport will have more than doubled from the 42.5 billion gallons used in the early 1960's. Jet aircraft and automobiles will account for most of the increase, and they are both inefficient users of fuel in terms of the transportation they produce. "Future petroleum commitments begin to look alarmingly sizeable," Professor Richard A. Rice of the Transportation Research Institute at Carnegie-Mellon University told the American Society of Mechanical Engineers early this winter.

Pollution Economics

Though we often proclaim that environmental quality can be better assured by conventional economics than by ecologists' "preaching and scaring," can economic incentives in fact lead the marketplace into the right decisions? Yes, says Richard A. Carpenter, Chief of the Environmental Policy Division of the Library of Congress Legislative Reference Service, if Americans can in fact come to "understand how the free services of a healthy environment contribute to economic prosperity." (An example: the Japanese, having destroyed with insecticides the entire insect population in many regions of the country, must now pay laborers to pollinate fruit trees by hand.)

Emotional controversy will not help. Neither will an international trade war, pitting the U.S.—whose concern for the environment may raise its industries' apparent costs—against foreign nations with fewer environmental constraints. Neither will arbitrary limitation of pollutants. Indeed, arbitrary controls are a denial of the potential of technology.

We do have systems and processes for developing environmental improvement and for weighing their cost in the marketplace, said Mr. Carpenter at an M.I.T. conference on New England industry and environmental quality early this winter. To capitalize on these advantages we need a combination of flexibility and incentives which can best be developed within today's balance between governmental power and industrial incentives.

Indeed, said Robert M. Solow, M.I.T. Professor of Economics speaking on the same program, arbitrary controls and piecemeal remedies which affect a single industry or even a single product may in fact so warp the market as to be at least inefficient, perhaps even harmful. (For example: if we force one process to control its pollutants, the price of its product may be raised so much than an alternative process becomes more popular. Then, at its increased production level, the second process turns out to be far more damaging than the first. What then, unless a further contribution to the web of artificial control and arbitrary management?) Only where danger is direct and clearly perceived, said Professor Solow, can government control be a reasonable response to an environmental danger.

But Thomas J. Galligan, Jr., President and Chief Executive Officer of the Boston Edison Co., left the audience uneasy. He reported that fulfilling government standards by using low-sulfur oil will cost Edison customers $30 million in 1971. The expense, he said, is unjustified; with only a few years' postponement of the requirement, Boston Edison could have met it by applying new technology to existing plants and fuels.

"Wait until they start paying the bills," he said, "and then the American system will start working again."

What To Do Besides Yell for Help?

If you begin to clean up an oil spill within 15 minutes, it will cost perhaps $1.50 a gallon. Fifteen minutes later, the cost rises to $20 a gallon. It would seem infinitely practical to get right to it. Yet in how many of the vulnerable areas on our coasts can people move into action that quickly?

Wilbur Marks, of the Poseidon Scientific Corporation, made the simple observation at M.I.T. last fall that perhaps those places prone to oil spills—all of our coastline except the southeast—ought to establish what should be done when one happens, in advance.

First, Mr. Marks explains, one lists what one can do: containment, removal, dispersion, absorption, sinking, burning, and ("Ignore it—nature will provide") biodegradation. Then one lists why one cannot do some of these things. If the sea bottom is covered with shellfish beds, one ought not sink the oil. If the beach is used for recreation or covered with houses, one does not want to burn. Wind direction and velocity, temperature, sea swell, current, the type of oil, the quantity, the shape of the harbor or coast, and so forth, will make some actions more or less useful. One also surveys what one has: the equipment that can be brought, or can be constructed quickly on the site, or that local oil or harbor industries can be persuaded to buy for themselves, and what human resources can be used. Finally one decides how much one can afford or must pay: whatever, said Mr. Marks, is the least possible to quiet public discontent with the unpleasant mess.

One is left, probably, with half a dozen different actions or combinations of actions, appropriate for different sets of conditions. One is prepared to move in, he hopes, within that first 15 minutes. To convince his audience of the need, he adds that the Torrey Canyon disaster cost $7.5 million to clean—no doubt more than it need have because the French believed the spill would hit the Normandy coast, and prepared accordingly, while the oil came full upon undefended Brittany. The Santa Barbara spill has cost $5 million, with $4 billion yet outstanding in damages against the Union Oil Company. And one classic spill of only 1,200 gallons cost $90,000 to clean—$75 a gallon.

Saving Waste Heat

For every kilowatt of electricity generated, at least 2 kW. of heat must be discarded—which is another way of saying that most power plants, steam or reactor, are now about 33 per cent efficient. The result is that the waste heat disposed of by U.S. power plants is now more than enough to heat all the homes in the country.

But that equation masks the problem. Heat, when discharged by an efficient power plant, is at a low temperature, hard to use and inefficient to transport. And heat

is most needed in the winter, when waste heat is most easily disposed of. Despite these paradoxes, must heat be emitted as a pollutant into the environment through rivers, lakes, and atmospheres?

Perhaps not all of it. Some alternatives were suggested by two speakers at the 1970 annual meeting of the American Society of Mechanical Engineers:

◊ If you think of heat as a useful product, like the electricity, perhaps you can achieve a higher overall efficiency by designing to discharge it at temperatures between 200° and 400°F. instead of the usual 100°. If you do, said S. E. Beall, Jr., Director of the Reactor Division of Oak Ridge National Laboratory, the heat can be competitive with fossil fuels for home heating within 10 miles of your plant. And the summer heat demand—for driving air conditioning—may be higher than winter demand for heating.

◊ Heat can be used to speed sewage treatment, by increasing the rate of evaporation in separating tanks.

◊ Heat can be used for aquaculture. A large-mouth bass in 81°F. water can grow to twice the size of a bass in 68°F. water, said J. A. Nutant of the Environmental Systems Department of Westinghouse Electric Corp.

◊ Heat can be used by communities near the ocean for sea-water desalination.

◊ Heat can be used to de-ice and de-fog airports—occasionally.

◊ Heat, even at the most efficient lower temperatures, is good for greenhouse heating. Research at the Oak Ridge National Laboratory shows that heat from a 1,000-MW. power station is sufficient to heat 300 to 500 acres of greenhouses in the winter and cool them in the summer—in which $27,000 worth of vegetables can be grown per acre per year; delivered, the heat may cost 20 cents per 10^6 Btu., no more than a fifth of fossil-fuel cost. If the greenhouses are in the exclusion area surrounding a nuclear reactor, they have the double advantage of being close to the heat source and on land which may otherwise be wasted.

◊ Another suggestion: use warm water for irrigation, increasing the rate of plant growth and prolonging the growing season.

The Energy Industry: Progress—Into Doom?

Sales of chemical and allied products are the usual measure of progress in the chemical industry, and these have increased at a remarkably constant rate of 8.2 per cent per year for the last 50 years (*see next page*). Meanwhile, U.S. energy consumption, regarded as the best quantitative measure of the state of industrialization and standard of living, has grown at a remarkably constant 3 per cent a year since 1850.

Within these broad outlines there are some interesting variations, and when the growth curves are extrapolated for one or two decades there are some substantial inconsistencies between supply and demand, all of which appeared in papers and discussions during the convocation this fall celebrating the 50th anniversary of M.I.T.'s Department of Chemical Engineering.

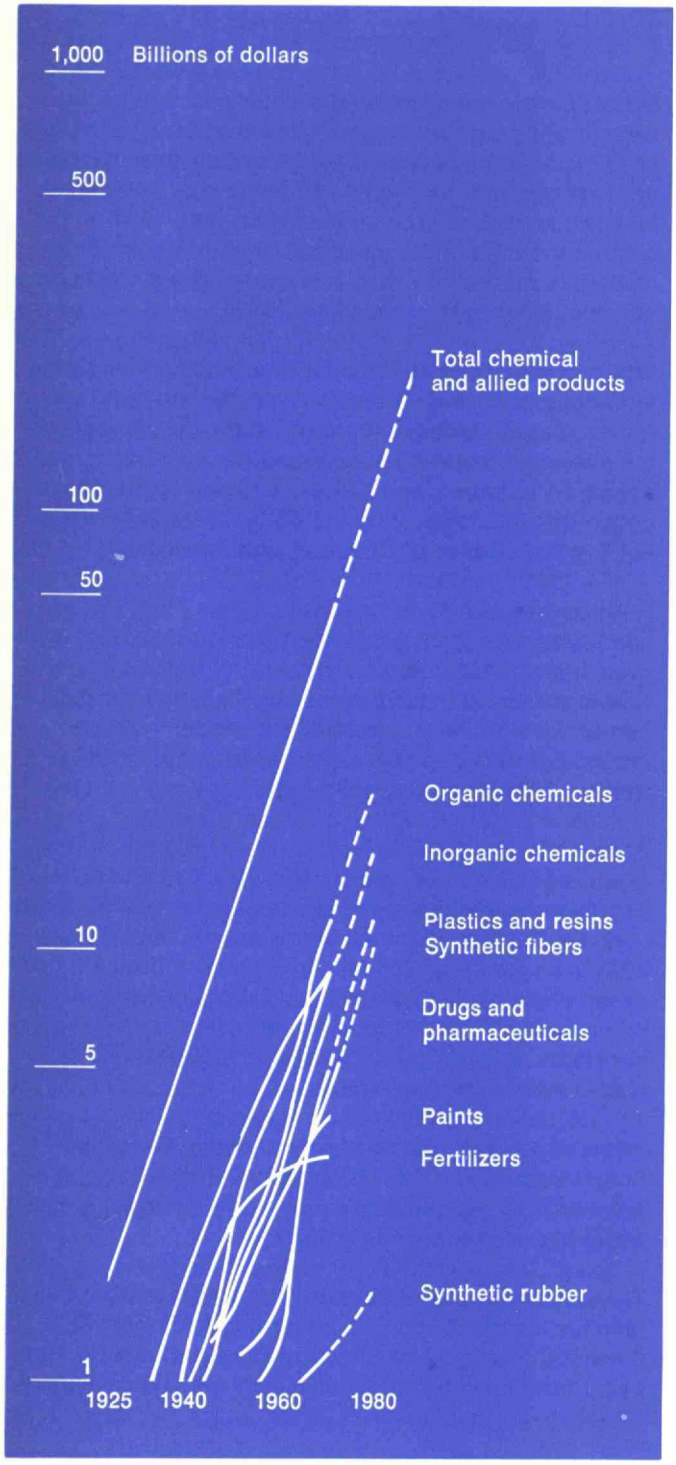
Plastics and resins, and synthetic fibers (each 15 per cent) are the biggest factors in chemical engineering growth since 1925, fertilizer (2 per cent) and synthetic rubber and soap (each 5 per cent) the smallest. But compared with these, the relatively modest but immutable growth of power consumption may be our Achilles heel.

From 1860 to 1900, said Hoyt C. Hottel, Emeritus Professor of Chemical Engineering at M.I.T., per capita energy consumption in the U.S. was relatively constant —about 100 million B.t.u.'s per person per year; by 1920 the figure was 200 million B.t.u.'s, and now it has climbed gradually to 340 million B.t.u.'s. This is about 70 times the human caloric intake—which, said Professor Hottel, is another way of saying that each of us now has 70 slaves working for him.

While our use of energy has been rising, our gross national product has risen far faster. Corrected for inflation, we now get about twice as much g.n.p. for a given expenditure of energy as in 1930.

Three-fourths of all U.S. energy now comes from the combustion of oil and gas, according to Robert C. Gunness, President of Standard Oil Co. (Indiana). Ten years from now, he said, petroleum will still be supply-

Sales of chemical products have increased steadily at about 8.2% per annum for the last fifty years. "Everybody knows that the growth curves have to bend sometime," says Professor Hoyt C. Hottel—but our Achilles heel may instead be power consumption.



ing 70 per cent (instead of 75 per cent) of all energy; natural gas will be a smaller factor in the energy market, coal and nuclear power larger, in the 1980 energy market. Indeed, Professor Hottel suggested that coal is "due to come back as a major source of energy in the future."

If total energy demand continues on its present course, consumption will increase by 50 per cent by 1980 and 125 per cent by 1990. Clearly, said Mr. Gunness, this will be "so great as to strain all available sources of supply." Modest increases in efficiency may be possible and the search for exotic energy sources will continue, but new technology applied on a massive scale takes "a great deal of time," he warned. Hence his conclusion that energy demands for the next decade "are going to have to be met very largely with presently known science and technology and from presently known energy sources." Even now we face "the possibility of the first significant peacetime energy shortage within memory," and—though this short-term situation can be overcome by expedient means—"the longer term shortage will only be overcome by massive efforts." All this has brought the petroleum industry to the point of "major growth in our technical base," said Mr. Gunness.

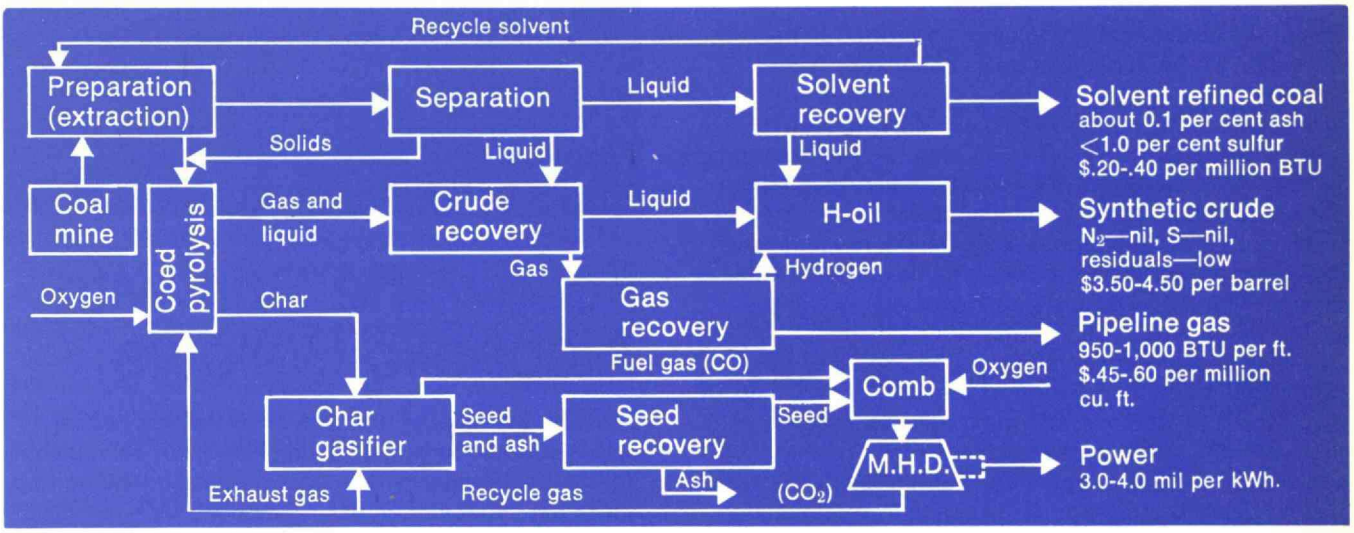
What is the upper limit? "You cannot get excited about doom being just around the corner," said Professor Hottel; "but everybody knows that the growth curves have to bend sometime, and you can't conclude that doom is impossible."

Coal for All Purposes

The school of thought that holds that, next century, most electricity generated in the U.S. will come from nuclear power plants, is always assured of an audience. There is still, however, a school which holds that there is plenty of coal left—indeed, a helluva lot of coal, to quote Mr. Neal P. Cochran of the Office of Coal Research (which resides within the Department of the Interior).

Since 1960, the Office has been encouraging research on the conversion of coal into fluid fuels (and, of course, into electricity). It has been found that any method for generating "oil" from coal produces a cer-

From the Office of Coal Research comes this scheme for the multiple use of coal, with adjustable relative outputs. The component processes are subjects of a number of separate current research programs.



tain amount of gas; and that, conversely, gasification often results in a liquid by-product. In both cases, a solid "char" is left over from any economical process.

For some years, Mr. Cochran has been sketching out processes which would simultaneously generate oil, gas, and (using the char) electricity, in variable proportions. He presented the latest version to the American Chemical Society this fall. It would consume 75,000 tons of coal a day, converting it into 100,000 barrels of "crude oil," 300 million cubic feet of fuel gas, 48 million kWh. of electricity, and 5,000 tons of "solvent refined" coal. The overall thermal efficiency of such a plant is reckoned at 73.3 per cent. The total cost, including the coal mine, would be $700 million—"equivalent to two manned space flights." The output mix would be variable, to allow for seasonal shifts in demand.

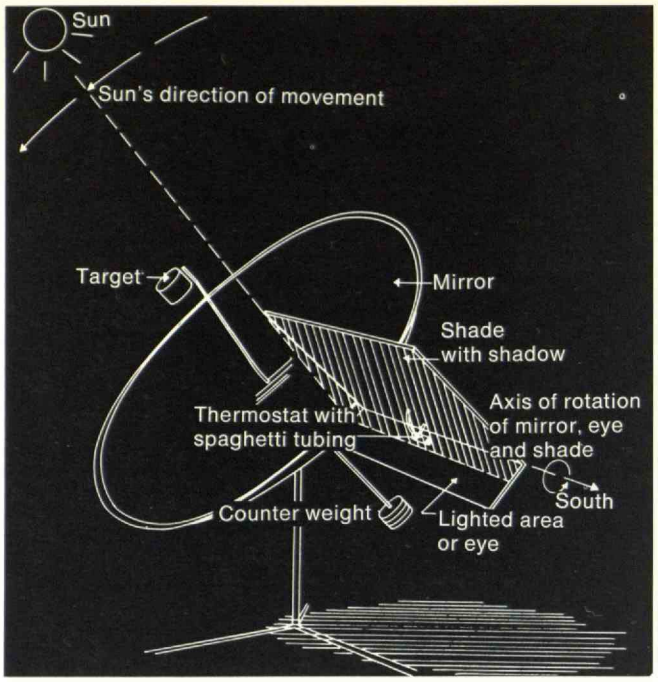
Mr. Cochran views this approach as not only "consistent with environmental goals established by the President" but as providing new jobs in rural regions, thus easing the troubles of the cities. And it would, according to his calculations, ensure adequate national energy supplies "not for next year, not for the next ten years, but for the next 100 or 200 years."

The Vulnerability of Ownership

If one is doing business in a foreign country (mining, perhaps), is it better to own the assets entirely, or to share ownership with the locals, or what? The traditional U.S. approach has been 100-per-cent ownership, particularly in the less developed countries. But as the host country gains in technical knowledge and in strength, the future of the U.S.-owned company begins to be contingent on factors beyond the owners' control. The owners may suddenly find that the concern has been nationalized, with no real possibility even of negotiating the price.

Richard D. Robinson, of M.I.T.'s Sloan School, holds that there are many practical "ownership strategies"—ranging all the way down to purely contractual arrangements—and that a sober consideration of long-term costs and benefits may well result in the rejection of full ownership in favor of something less "politically vulnerable." And yet, he says, his researches have not turned up a single multi-national company which has tried rationally to estimate, and then reduce, its "political vulnerability"—that is, the probability that serious trouble will be created by an economy-minded local government which suspects the company of profiting more than it deserves or of controlling more assets than its presence is worth. ("Political vulnerability is a func-

The sun-tracking system of this solar-energy collector senses temperature with a bellows filled with alcohol. When the bellows emerges into sunlight, it unclamps a rubber tube, activating a simple fluid drive.



tion of the cost/benefit ratio of an enterprise *as perceived by* the local political decision makers.")

In particular, Dr. Robinson told an M.I.T. Industrial Liaison Symposium this fall, the idea of joint ownership —and with it, shared profits—is generally rejected, on the ground that "it makes management more complex." If this reasoning is sound, it is never rigorously shown to be. If managements are trying to maximize not long-term profit but power, this should be made explicit.

The less developed countries are beginning to be noticeably influenced by the example of Japan, said Dr. Robinson. The one overwhelming national success of the postwar years has been achieved by a country in which very little foreign capital was invested, but which instead absorbed foreign technology. The implication for less developed countries—as many of them see it—is clear, and moreover it is reinforced by Japan's own behavior as it begins to reach across the globe. Japanese multi-national concerns tend to choose co-ownership, which the host countries see as less subversive than complete Japanese control would be.

A few days after this symposium on "The Multi-National Corporation" was held, the *New York Times* carried a report from Lima, Peru, which strongly suggested that Dr. Robinson's giants were far from being windmills. The Peruvian government (a group of soldiers who, socialists or not, are at least patriotic) has already declared its intention to nationalize all mines which remain unexploited and all mining operations which do not double their capacity. Some operators view these conditions as hopeless. Not so Anaconda, which has an unworked copper deposit. The *Times* reported that "behind closed doors," Anaconda was working out the following salvation: it would keep 40 per cent of its Peruvian property; another 40 per cent would go to the Peruvian government, for free; and the rest would be acquired by the Dawa Iron and Steel Company of Japan, as a reward for financing the commencement of mining operations on Anaconda's neglected ore. Other foreign-owned mining companies in Peru are reportedly "shocked" at the thought that they may have to do something similar themselves.

Follow the Sun with Alcoholic Bellows

Consider the lilies of the field. They employ neither opto-electronic transducers, amplifiers, nor servomotors. Yet their solar-energy receptors possess orientation optimization capability. By taking thought, Mr. Day Chahroudi of the Zomeworks Corporation, Albuquerque, N.M., has constructed a high-temperature solar heat collector which does likewise.

High-temperature solar heaters—in which the sun's rays are concentrated by a mirror—must be steered as the sun moves around the sky. Electronic tracking devices are expensive, and their maintenance can be a weak point in an otherwise simple technology. But Mr. Chahroudi's system could be constructed by a competent mechanic from generally available materials.

A flat screen is fixed to the collecting mirror, positioned so that if the latter is falling behind in its sun-tracking, a small bellows containing alcohol emerges from its shadow into direct sunlight. The alcohol boils, lifting a valve and opening a rubber tube. This allows water to pass from one flexible container to another (under a force provided either by gravity or by spring-loading one wall of one of the containers). The consequent shrinkage of one water-container and expansion of the other drives a cable, which turns the axis of the mirror until correct orientation is restored.

This system was described to the American Society of Mechanical Engineers at their Winter Meeting in New York. Some may feel moved to remark "Rube Goldberg!"; some may, on the other hand, feel that the truest tributes to the late master (who died early in December) are to be found rather, concealed from the vulgar gaze, within the encapsulated mazes of modern circuitry. *Si monumentum requiris . . .*

Experimental Subjects Are Just Plain Folks?

Experimental human psychology can be done only with people; but people differ from other objects of research in that they may or may not cooperate with the experimenter. The existence of "subject variables," governing the kinds of cussedness that can complicate the psychologist's observations is recognized, but that's about as far as it goes.

Professor Ronald E. Walker, chairman of Loyola University's Department of Psychology, told the American Association for the Advancement of Science this winter that "even though there has been a dearth of research focused on subject variables, there is a burgeoning concern about this seemingly overlooked area. . . . It is probably fair to say that the subject is being rediscovered by psychologists but that they are not yet sure what to do with him or her (not it)."

The irony of all this does not go entirely unnoticed. Dr. Walker admitted that the researcher "wants his subjects simple and complex . . . naive yet representative of their kind . . . . In short, the experimenter wants a human subject that isn't." If the college student—as the subject usually is—behaves with the full unpredictability and irregularity of his species, it will be hard to bring the experiment to a clear conclusion.

As a start, Dr. Walker presented "a partial taxonomy of the types of experimental subjects . . . for which there is at least some relevant literature." He described:

The Concerned subject
the Deceived subject
the Faithful subject
the Second-Guess subject
the Aware subject
the Missing subject (Dr. Walker's bibliography, of more than 100 references, includes a study of "the bias related to sampling and generalization that could result from the loss of the data that missing subjects are expected to provide"; but to proceed:)
the Lonesome subject
the Willing subject
the Laughing subject
the Recidivistic subject
the Bored subject
the Infected subject (who copies the experimental behavior of other subjects)
the Guilty subject
and that "most overt betrayer of experimenters," the Traitorous subject.

Subjects can be of more than one type: faithful, aware and willing, for instance. There may be other types of human specimen which have not been documented. There is one type which Dr. Walker left out of his list because he considered it extinct—the Naive subject. These days the subject nearly always knows something about what it is like to be an experimental subject before he arrives at the laboratory. The experimenter, on the other hand, probably knows less about the subject than he usefully might.

The proper study of mankind remains what it was.

The Chemicals Around Us

Back in the 1940's, that radiation caused mutations—changes in genetic material—was recognized; standards for use were set up even before the danger was defined. And now, attention is turning to another, possibly broad, source of mutations—the chemicals we carelessly surround ourselves with.

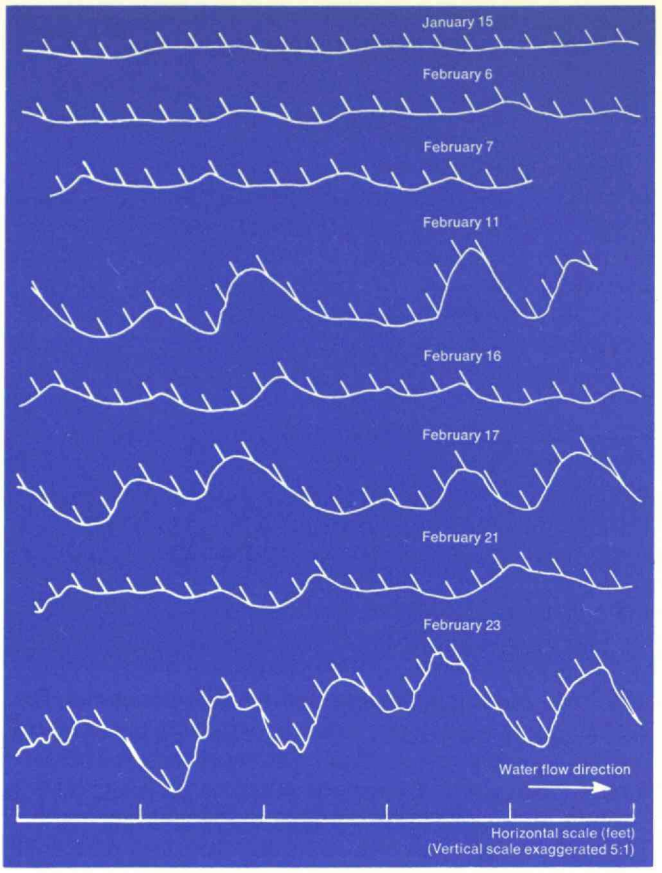
A Conference on Evaluating the Mutagenicity of Drugs and Other Chemicals was sponsored this November by the National Academy of Sciences—a conference which left one with a great respect for the body's sensitivity and subtlety and for the fragility of its chemical balance. And a little concern.

Each cell in the human body contains a complete set of genetic material (a genome), perhaps 3 million genes strung together in chains called chromosomes. Ideally the genome is identical in every cell. Each individual cell is directed during its life by that set of genes, and directly or indirectly by hormones issued by groups of cells called glands.

The possibilities of error in making genes for new cells are richly varied. It is only through mutation that any change happens in life's possibilities. If it occurs in a germ cell, an ovum or sperm, the changes are dictated to the fertilized fetus which results. Mutations arising elsewhere in the body are less far-reaching, and are called somatic. Many mutations simply make for variability: blue eyes or brown, stocky bodies or slight. Of human genes, half have variant forms—the gene for hemoglobin has over 100 variations.

How often mutations occur is unknown. But all but one in a thousand are neutral or harmful. (A like number are repaired by the cell.) Few grossly misshape or grossly impair an individual. The great majority are simply detrimental. As Dr. James Crow, of the University of Wisconsin, pointed out, they weaken resistance to disease,

The underside of the ice on a frozen river is flat, to start with. During periods of melting it is "sculpted into ripples and dunes", which impede the flow of the water and thus take a hand in the thawing process. Understanding of these mechanisms may contribute to flood prevention.



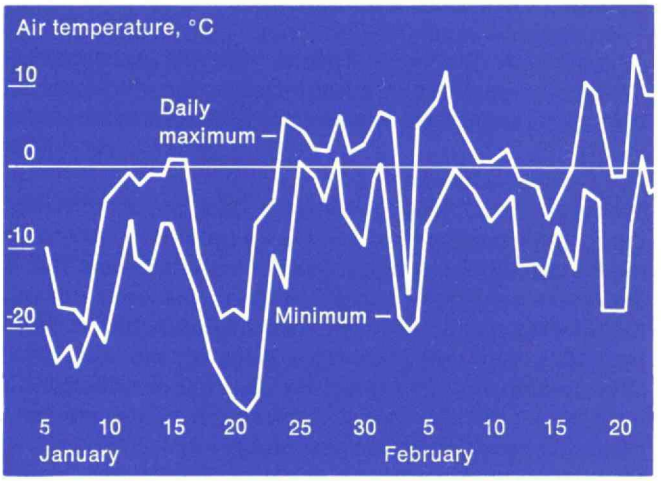
or make the body unable to use a particular food, or make it infertile, or shorten its life. This slender visibility is probably a mutation's greatest danger—and therein lies the concern of the scientists gathered at the N.A.S. conference.

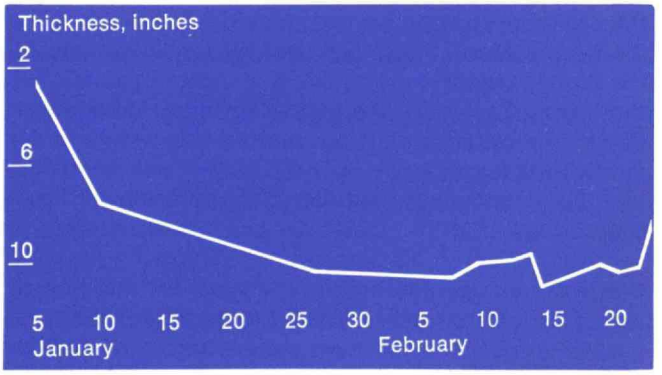
Mutations are becoming more visible as causes of disease, Dr. Crow said, simply because other causes, parasitic and bacterial infections, are curable and people less often die from them, at least in the advanced countries. We also know how to counter some genetic damage, so that people with faulty genes are living and sometimes reproducing. Combined with a lowered birth rate, this means we are already tampering with natural selection, he said. (Another biologist described this as genetic engineering, of a simple sort.)

We have put, Dr. Crow continued, all manner of chemicals into our world—there are over 700 compounds on the F.D.A.'s Generally Recognized As Safe list of food additives—and we know close to nothing about what most of them do. Only that many chemicals are proven mutagens. No test of mutagenicity is required for any class of compounds. And, he added, a mutation hangs around for a long time—a half-life of 20 to 40 generations.

Dr. Samuel Epstein, of the Children's Cancer Research Foundation in Boston, pointed out that chemical mutagens have a danger that radiation doesn't—they stay around longer.

If we're doing it, Dr. Crow asked, shouldn't we know what we're doing?





Water in Its Solid State

"In the land of the blind, the one-eyed man is king." Thus it is, says John F. Kennedy, Director of the Iowa Institute of Hydraulic Research, that he presumes to talk at symposia—such as M.I.T.'s on Water Environment and Human Needs this fall—about the hydrodynamics of river ice: it is "a byway of the hydrologic cycle that has received relatively scant attention."

We are ignorant, for example, of most details—in quantitative terms—of the seasonal sequence of ice forma-

tion and melting. The first ice forms on cold nights as single crystals, and when daytime radiation fails to melt these fragile structures they gradually agglomerate into sludge ice. Here begin the problems: sludge ice is highly adhesive, so it tends first to gather at points of low velocity to create small-scale surface jams of platelets of fragile yet lasting ice.

By midwinter this sludge has further gathered, and weathering processes—in the absence of snow—produce a flat, smooth ice surface. But the underside of that ice sheet, at the interface between frozen and moving water, is sculpted into ripples and dunes. Research reveals that these undulations develop only during periods of melting; the bottom of the ice sheet when first formed and during the freezing process is smooth.

By the time the spring run-off begins and heat flows to the ice from the water beneath, this roughness of the ice-water interface slows the current, increasing heat flow to the ice and the melting rate, yet reducing the water velocity. Some of the ice thus melts in place. But as all riverside dwellers know, most of it weakens, breaks into blocks, drifts downstream to gather below against whatever obstacles may be present, and thus leads to ice jams and consequent floods and property damage—sometimes extensive.

Can a better understanding of all the mechanisms involved help prevent such ice jams by making possible something which Professor Kennedy calls "river management"?

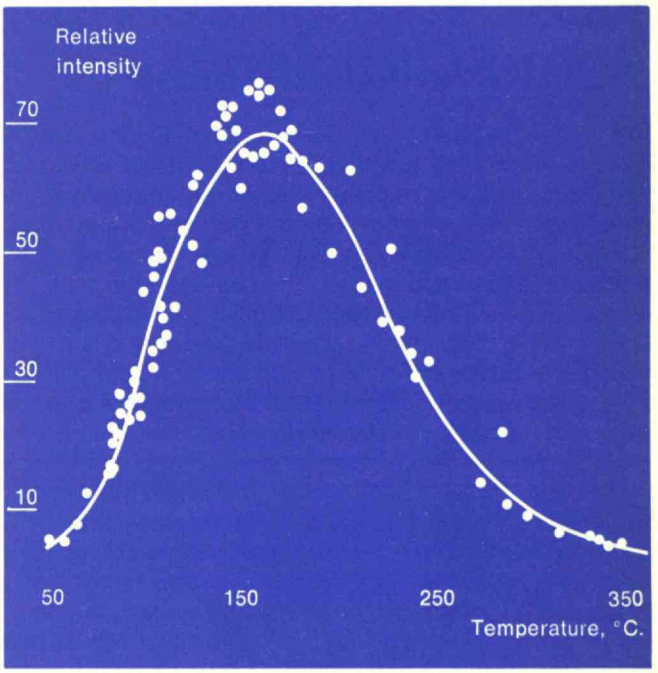
What Future for the Gas-Mantle?

The true nature of the relationship between science, technology, and the public good is nicely illustrated by the story of the gas-mantle—a story to which a new chapter is now being written by an adventurous interdisciplinary team at Pennsylvania State University.

In 1887, Carl Auer von Welsbach exhibited in London the product of many years of trial and error: it was a fragile white network, made of the oxides of thorium and cerium. Heated by a coal-gas flame, it gave off an almost white light, quite unlike the dim orange glow that would ordinarily have been expected at the same temperature. The "gas-mantle" solved the problem of how to obtain illumination from coal gas, and by the turn of the century gas lamps were conventional for city lighting. Their efficiency—thermal energy to light—never exceeded about 1 per cent, and after a few years the electric lamp took over, with its straightforward high-temperature black-body filament.

Von Welsbach's device lives on, mainly in portable oil- and gas-fueled lamps (and in such archaephilic locales as Beacon Hill, Boston). There is an extensive patent literature on the construction of electric imitation gas-lamps, which combine the gleam of spurious maturity with adherence to modern fire regulations.

Luminescent intensity of a lightly-doped yttrium oxide, Y_2O_3:Tb (0.143 per cent), in the presence of a hydrogen flame, passes through a maximum at only 160°C. Clearly the light-emission is not thermal. The effect was used to light city streets in pre-electric years, but only now is it coming to be understood. (From a recent publication in Physics Letters, *Vol. 33A, No. 3, p. 195.)*



What was it about thoria and ceria that did the job so well? The truth is that nobody knows. The theory presented in the current encyclopedias of science is taken from a publication by one H. Rubens in 1905. The story (paraphrased, let it be understood, from a respected reference source) is that the emissivity of thoria in the infrared is low, and thus the mantle is unable to lose much heat in the longer wavelengths. The thoria therefore—so the theory runs—reaches a far higher temperature than would a "black body" in the same flame. The emissivity of thoria is low also in the visible, and the ceria (one per cent of the mixture) comes to the rescue with its high emissivity in the blue-green.

Thus, the gas-mantle is supposed to give off a modified version of a thermal-radiation spectrum. Not so, say the Penn State researchers. The mantle's light is truly nonthermal. It is a kind of chemically pumped luminescence, which occurs when certain oxides are placed in flame generating certain chemical species, particularly the OH group. One of the team, William B. White, is quoted thus: "If the basic physical processes responsible for the luminescence can be understood in terms of active molecules in the flame, and crystal structure and chemistry of the phosphor host, it should be possible to build systems to produce light from flames at

lower temperatures than thorium oxide, or even a flameless cold light." He goes on to confound H. Rubens yet more thoroughly, by suggesting that an infrared variety of "candoluminescence" might occur, and if it did, would be useful for space heating.

Latest reports from Penn State's Materials Research Laboratory are that terbium-doped oxides of lutecium and yttrium (Lu_2O_3, Y_2O_3) both show a light-emission peak at 160°C, a temperature far too low for thermal effects to be significant as a source of light. A flame is not essential. It appears that the gaseous species involved is not H, as was once thought, but OH, in a neutral excited state.

Medical Engineering: Some Criticisms . . .

The Northeast Electronics Research and Engineering Meeting—a late-fall function of the Institute of Electrical and Electronics Engineers—reflected an increasingly serious interest in medicine on the part of the electronic community. More time was devoted to it than to any other one field of application. The chairman for next year's N.E.R.E.M., Dr. Herbert Sherman of M.I.T.'s Lincoln Laboratory (this year's Vice-Chairman), is a designer of satellites who now works on the improvement of the care of outpatients, in a cooperative program with Boston's Beth Israel Hospital.

Beth Israel's director, Dr. Mitchell T. Rabkin, observed that "it was not the burgeoning of technology that sprouted the hundreds of firms now manufacturing clever devices for use in the hospital; it was rather the availability of dollars in the health care system, the development of a market. The mushrooming of companies possessing 'think tank' leaders, futuristic logos on their letterheads, and Buck Rogers names has flooded the unwitting managers of American hospitals with—in large measure—an outrageous, expensive, unsafe and useless collection of junk."

Dr. Rabkin went on to suggest that the era of good feeling between medicine and technology has now "passed its zenith." The buyers are no longer so naive, and the irresponsible companies will begin to fall by the wayside.

Dr. Oliver Fein, of the independent Health Policy Advisory Center, New York, was rather more pessimistic. "Just the availability of an array of technological diagnostic tools," according to Dr. Fein, "has a momentum that often carries diagnosis beyond the actual needs of the patient. Can patients be assured that technology will be used to their benefit?" (as distinct from that of the doctors and hospital administrations) "As long as medicine remains unaccountable to patients this question remains unanswered."

Another source of danger, Dr. Fein considers, is that the suppliers of innovative technology are not neutral as to kinds of equipment they find it easiest to supply. The main emphasis is "not on products and services which would improve basic health care for the great mass of consumers, but on what are essentially luxury items: computerized equipment for intensive cardiac care units, hyperbaric chambers, etc. Under the pressure of the industry's barrage of packaged technology, the delivery system is increasingly distorted towards high-cost, low-utilization, in-patient services."

...Some Requirements

Dr. Fein's recommendation was a democratic restoration of checks and balances, in which "new forces are brought to bear on the American health system, from patients and lower-level health workers."

But, in technological terms, what are the unsatisfied needs? "The greatest need in the field of medical technology today," said Dr. L. R. M. Del Guercio of the Albert Einstein College of Medicine, New York, "is for the development of new physiologic sensors." Dr. Guercio quoted with approval the observation that "in the present state of the art, any monitoring device which reduces the frequency of contact between the professional and the patient may be expected to adversely affect the quality of patient care."

As an example of a good sensing technique, he chose electrocardiography, which gives useful information about the working of the heart without in the process disturbing it. It uses signals generated by the heart itself: such a sensing system "from the standpoint of information theory . . . is richer in information than one based upon extrinsic energy probes such as X-rays or ultrasound." Electrocardiography (E.K.G.) is now nearly 70 years old. Two co-authors of Dr. Del Guercio's paper were from Mechanical Technology Incorporated; the team is trying to emulate the success of E.K.G. using the body's far-infrared emissions at the cellular level.

"Engineers and physicists alike," according to Dr. Del Guercio, "have been burdened by preconceived notions regarding the need to record blood pressure, pulse rate, respiratory rate, and temperature." Some of the phenomena and conditions urgently needing sensing methods, he said, are: abnormal bio-energetics, as in cancer tissue; the viability of various organs (of interest in relation to the "alive or dead?" quandary that arises increasingly often over the beneficiaries of the extremer forms of medical care); the effective performance of organs, as distinct from the evidence of malfunction that is found in the bloodstream when they fail; and oxygen tension within the cell (another speaker, Edward R. Merrill of M.I.T., noted a need for many kinds of chemical sensors—of glucose, for example—in the field of organ replacement).

It would be wrong to give the impression that the problems of modern medical technology are all new and subtle. Dr. Morris F. Collen, of the Kaiser Foundation Research Institute, speaking of engineering requirements for public health screening, assigned top priority to "on-line, machine-readable patient identification." The question is not just what is wrong with you, but what is wrong with who?

Cambridge Journal

Cap and Gown for A.D.L.?

"Hooray! I got accepted by Arthur D. Little!" In the future this may not be the cry of some middle-aged professional seeking a job—but that of an eager business school applicant.

Arthur D. Little, Inc., the Cambridge-based consulting firm, is seriously considering going into the education business. The company has now applied to the Massachusetts Board of Higher Education for the authority to award degrees in two courses in management—one of which is already six years old. Edward C. Moore, Chancellor of the Massachusetts Board of Higher Education here, thinks it may be the first time a profit-making company has asked for such authority for this purpose.

One observer who attended A.D.L. "graduation" last year in the 19th-century mansion of the American Academy of Arts and Sciences in Brookline says it was "just like a real commencement. It was a very dignified ceremony, with an address by Angie Brooks, President of the General Assembly of the United Nations, and remarks by General James M. Gavin, Chairman of the Board of A.D.L., and they handed out certificates!"

Robert D. Ward, Director of Management Education at A.D.L., explains that the courses involved in the application are designed for persons from developing countries. One in agro-industrial and industrial development trains 20 Africans a year; another which started last year trained 23 Iranian students in industry management.

Should A.D.L.'s proposal be accepted, it will become a national first. Many states, including New York, Illinois, and Washington, D.C., can grant degree authority to proprietary corporations. But in the past Massachusetts has only granted such authority to single-purpose "educational" organizations, such as the Katherine Gibbs School for secretaries. At stake now is the chance that the giant corporation might go into higher education—and for a profit. The A.D.L. proposal is reported to have some people in the academic world a little worried. Education, after all, has been the unique prerogative of universities and colleges. Even schools of management science and business have regarded training in those areas as their own domain, despite the fact that already General Motors, for example, offers courses in engineering and even auto marketing. But those at A.D.L. are anxious to point out that their two courses do not encroach on management schools' territory.

The proposal currently faces two obstacles. First, a legal verdict must be reported out of the state Attorney General's office on whether existing state law prohibits the plan. If a legal green light is forthcoming, Graham Taylor, Executive Secretary of the Boards of Higher Education of Massachusetts, says the Board will pass on the degree-worthiness of A.D.L.'s two courses. In the meantime, the universities are eyeing their own tightened purse strings—and A.D.L.—and waiting.

Bicycles, Babies, and Good Sense

How far has science penetrated into the average American's ways of thinking?

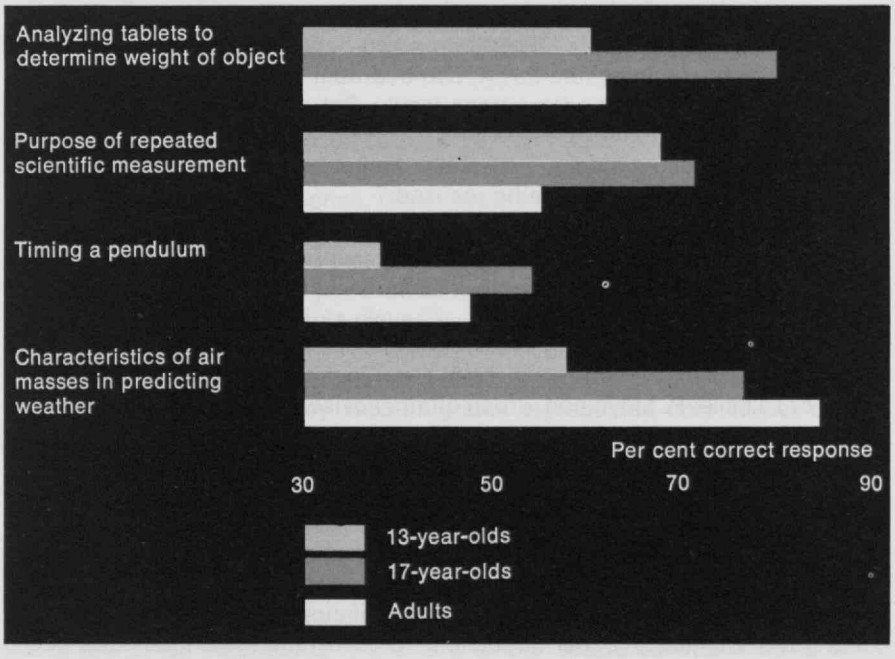
A long way, surely. But how far depends at least partly on what you define as science and what you call common sense, the "science" that most of us have and use.

The National Assessment of Educational Progress, a project of the Education Commission of the States, has now published the first results of its studies of the knowledge and skills held by children and young adults in subjects taught in schools. In science, it finds:

◇ Nine-year-olds do well on "commonplace phenomena" and properties of matter which can be considered as "facts and principles of science." For example, 81 per cent recognize that day and night occur because the earth rotates, 92 per cent that a baby comes from its mother's body; given a beam balance, 96 per cent can balance two weights on it and 94 per cent can balance a combination of two weights against one. When confronted with a leaking bicycle tire, 72 per cent correctly say that the first thing to be done is to "find where the air leaks out." Difficulties increase with abstractions: only 22 per cent recognize this as a definition of "scientific theory": "it explains why some things act the way they do."

◇ Thirteen-year-olds do well on questions of scientific fact. By now, 98 per cent know that a baby comes from its mother's body and 79 per cent that fanning a fire makes it burn faster because of the increased oxygen; 89 per cent can select foods to make a balanced meal from among five alternative lists. They handle data in tables and graphs "especially well," says that National Assessment report, but their ideas of earth science are primitive: only 26 per cent can correctly explain how a fossilized fish can turn up in a rock at the top of a mountain (more than half said the fossilized fish was carried to the mountain by a great flood).

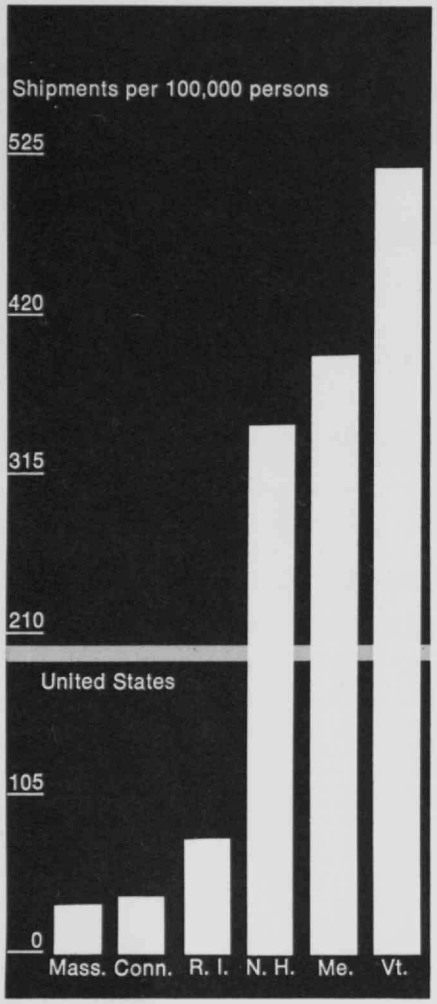
◇ To their parents, it will come as no surprise that 17-year-olds do better than the "young adult" category (age 26-35) at lots of tests, including knowledge of the periodic table, radioactive dating methods, wavelength problems, and the ability to interpret tabular data. Indeed, on a question concerning the possible reasons for repeating a scientific measurement, both 13- (69 per cent) and 17-year-olds (72 per cent) do better than adults (57 per cent). But



As a child grows to be an adult, he is presumed to gain in knowledge and skills. But the National Assessment of Educational Progress finds that 17-year-olds do better than their parents "in nearly all exercises associated with classroom experiences or textbook study" in fields of science. On the other hand, adults say "I don't know"—instead of giving a wrong answer—far oftener than their offspring.

adults use the "I don't know" response more than their offspring, suggesting that maturity makes one aware of (or more willing to admit) his deficiencies.

Adults do far better on questions relating science to common experiences. Which may simply be another way of proving that a good deal of science is common sense, and vice versa.



In the wealthier southern New England states, mobile homes are tightly restricted by local zoning and so are limited in the role they might otherwise play in the total of new housing units. But in the three northernmost states of the region, where per capita income is substantially lower, mobile homes are a significant factor in new housing. Neither area is representative of the U.S. norm. (Data: New England Economic Review)

Mobile Home: Low vs. High Cost, Needed but Unwanted

Though mobile homes still "conjure up images of migratory paupers or of military camps," they are finally becoming a major factor in new housing in many parts of New England. Indeed, Carol S. Greenwald of the research staff at the Federal Reserve Bank of Boston suggests that mobile homes "clearly offer a means of solving one of our most pressing social problems—providing low-cost housing in the suburbs so that low- and moderate-income households can live near the new job opportunities in suburban areas."

But the fact remains that most suburban communities exclude mobile homes by zoning and subdivision regulations. They have made inroads into the housing market only in the less affluent New England states: 67 per cent of 1969 housing starts in Maine were mobile homes, 2 per cent or less in Connecticut, Massachusetts, and Rhode Island.

Completely furnished, they cost $3 to $4 less per square foot to manufacture than unfurnished conventional homes. Because they are not classed as dwellings, their manufacturers need not conform to local building codes; craft workers are replaced by lower-paid industrial workers and greater mechanization is possible.

Only mobile homes on permanent foundations on resident-owned land are now eligible for mortgage financing, so most mobile homes are bought on consumer installment loans. This type of lending—usually at about 12 per cent interest—is so profitable that banks now prefer mobile home financing to most other consumer installment loans. This is both a hazard and an advantage: mobile home borrowers face considerably more adverse credit terms than mortgage holders, but they have been able to obtain loans when mortgage money was not generally available. New legislation, an easing of regulations on state-chartered savings and loan associations in several New England states, and availability of F.H.A. insurance on mobile home loans of up to $10,000 should improve the situation.

The average mobile home is larger than a two-bedroom apartment—45 per cent larger than the minimum F.H.A. two-bedroom apartment requirement. It is not a practical solution for a large family. But, says the Federal Reserve Bank study, mobile homes are now our "quickest and least expensive way of upgrading the housing stock." And states "must not let local governments prevent this opportunity from being realized."

Wanted: Intellectuals to Lead

If Howard W. Johnson, retiring President of M.I.T., thinks the prescription for his successor is that he be an educator (*see* Technology Review *for December, p. 67),* Daniel P. Moynihan, urban affairs adviser to the President, begs to differ: make sure he is an intellectual.

Dr. Moynihan's advice was stated this fall when he appeared before the American Council on Education to propose "fundamental reform in the relations between the national government and higher education.

"If there is to be fundamental reform in the relationships between the national government and higher education," Dr. Moynihan told the A.C.E. in a

keynote address to its 1970 annual meeting, "there will have to be leadership on both sides, there will have to be negotiations, agreements, oversight, revision. The higher education community is not now organized for any such effort. It has no such men. It seemingly comprehends no such undertakings," Dr. Moynihan declared.

"What is at issue," he continued, "is an adversary culture firmly entrenched in higher education. The nature of this culture, the extent of its strength, and its grip on the universities, as well as on other institutions of acculturation, have come as a surprise to many. The patrician tradition and leadership of the most prestigious universities seems to me to have been painfully vulnerable in its initial encounters with this new reality. It would seem to me that the individuals involved by and large could not understand or could not believe what suddenly was before their eyes, and, in varying degrees, panicked, collaborated, or simply collapsed. In this they displayed what I fear has been a problem of higher education—namely, that its leaders have not been especially well educated. For all the spectacular minds that from time to time have been put in charge of our great institutions, and smaller ones, on balance the leadership has been social and administrative—the right family or the right work habits—rather than intellectual.

"We have paid and are paying a price for this. For example, it has become increasingly clear that in the early postwar period the radical impulse in politics moved over into the culture where it prospered as never before. . . . When in the course of the 1960's the radical impulse returned to politics, this time greatly strengthened and legitimized by the culture, administrators . . . concluded that they were being confronted with something utterly new, altogether without precedent. We began to hear about the 'youth culture.' "

But, said Dr. Moynihan, "It would seem to me that the present state of campus politics and manners represents a clear continuity with earlier forms, allowing only for changes in scale. . . . There is no justification for having been taken so utterly unawares."

The Realities of Foreign Aid

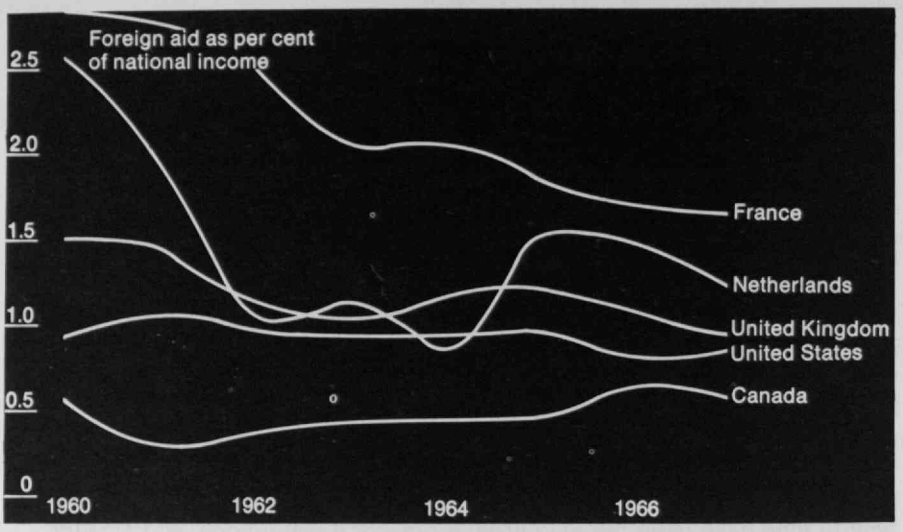
World foreign aid from the developed to the less developed nations grew apace in the 1950's and continued to grow—but at a lower rate—in most of the 1960's. But such statistics, based on the nominal values of funds appropriated and spent, are misleading; the true cost and value of foreign aid—taking into account the loan and so-called aid-tying conditions attached to many programs and the continuous rise in prices—may be 50 per cent less than the nominal figures.

Indeed, basic statistics "significantly understate the serious decline in the real aid effort which has occurred between 1960 and 1970," writes Jagdish N. Bhagwati in a monograph prepared at M.I.T. and published this fall by the Overseas Development Council. Given the true figures, says Mr. Bhagwati, "the disenchantment with the economic performance of the less developed countries during the 1960's (which is by no means inferior to either their own earlier performance or the performance of the developed countries in the same period) and with the role played by aid appears misplaced."

The amount of foreign aid provided as loans has increased threefold since 1956, says Mr. Bhagwati; by 1965-67 grants represented only 60 per cent of foreign aid flows, in contrast to over 80 per cent a decade earlier. Loan terms have on the average remained relatively constant over the period—3.1 to 3.8 per cent for 22- to 25-year maturities. However, says Mr. Bhagwati, these averages "conceal fairly wide variations in terms as among different donors at any point of time."

A more serious compromise in foreign aid performance comes from what is called aid tying, the practice of granting foreign aid funds with the proviso

Even measured against an index such as a nation's gross national product, foreign aid statistics can be substantially misleading, says Jagdish N. Bhagwati in a monograph written at M.I.T. for the Overseas Development Council. Both loan agreements and requirements which limit the ways in which foreign aid funds can be spent reduce the true usefulness of such programs to less developed countries, he says. Taking such factors into consideration, the effectiveness of the U.S. foreign aid program has been eroded in the 1960's despite its continuing large dimensions, says Mr. Bhagwati.



that they be spent on certain projects and/or in the granting country. Beginning in 1962, says Mr. Bhagwati, U.S. balance of payments difficulties led it to increasing use of aid-tying practices, and this in turn led other nations to follow suit.

Soon after World War II, when foreign aid programs came to be a common public policy in western countries, says Mr. Bhagwati, the U.S. played a "distinguished, enlightened, and catalytic" role. But more recently the U.S. position has been eroded; U.S. appropriations have declined when measured against national income and gross national product, and America's increasing use of loans and aid-tying has reduced its foreign aid totals adjusted by any of several formulas tested by Mr. Bhagwati. In all, France comes out as the best performing nation in the foreign aid field; "the large, absolute aid expenditures of the U.S.," writes Mr. Bhagwati, "actually mask an inadequate effort in relation to its perceptive income level."

What Next for Model Cities?

Last fall, Secretary of Housing and Urban Development George Romney announced a series of "planned variations" in the Model Cities Programs which will be tried in 12 to 18 of the nation's 150 Model Cities. The idea: to test experimentally ways of making government—federal and city—more responsive and efficient.

But Model Cities staffers in two of the 150 cities, Cambridge and Boston, react to the planned variations with concern: They fear the variations represent a tinkering with the machinery of Model Cities without providing either the funds or the visibility and priority on the national agenda needed to make Model Cities a success.

1. By far the most controversial proposal would expand the Model Cities geographically—opening the program to *any* poverty area in the city, but with no assurance of comparably increased funds. Staffers feel this is a grave threat. "It would take away the focus," said one. "The program is token enough now in terms of money and impact on only one area."

"This could completely emasculate the program," says a lawyer also working for Boston Model Cities. He listed ten other Boston areas which could compete for Model Cities programs and funds, should this "variation" be tried there. Another staffer said: "Instead of having a concentrated effect on one area, Model Cities would have no effect over the whole area."

2. Another controversial variation would give mayors the right to review, comment, and sign off *all* federal funds flowing into their city, including Model Cities funds.

Robert Williams, Executive Director of Cambridge Model Cities, reacted this way: "A mayoral veto over federal grants could mean getting more for your money through better coordination." But this would apply only in cities with "strong mayors" and "highly professional city government." In other cities with part-time city officials and in cities where mayors are less willing to make commitments to the problems of the poor, a mayoral veto could open the door to making federal funds allocations into political football.

A lawyer at the Boston Model Cities office cited one local example, Opportunities Industrialization Centers of Greater Boston, a private group funded by the Department of Labor. "O.I.C. has proven its ability to do things for the poor and for blacks. It is supported by the Labor Department which has a certain expertise on how its money ought to be spent. In this area, this means making very sophisticated judgments. Should a mayor have a veto over these judgments? What, for example, should the mayor do if the O.I.C. people are known to support his election opponent?"

Another reaction was disbelief. "If you compare the number of Republican mayors with the number of Democratic ones, the Republicans are far fewer. I can't believe that this administration is going to give all that money to the Democrats!"

3. There was almost unanimous agreement favoring the third proposal—elimination of all reviews on "supplemental and categorical" funds in cities except those required by federal statute. This would reduce the red-tape problem for local staffs and streamline reviews at the federal level. The plan follows directly from the recommendations of a recent presidential task force report which characterized Model Cities as "overregulated" and mired in red tape (*see left*).

"There are three levels of bureaucracy involved now," Mr. Williams says. "The theory behind eliminating these reviews is, that in the long run, it is cheaper to cut back at the federal level. This is sound."

But staffers in Boston add that their greatest red-tape problems are at the city level. Ever since the Nixon administration took office and altered somewhat the guidelines to the program, Boston Model Cities has been required to route all contracts, new programs, etc., through existing city departments. This increases Model Cities activities' exposure to local and state politics—and politics are at least as cumbersome as any kind of bureaucratic red tape, they say.

Needed: A Vote of Confidence

Asked for their own view of their problems, the staffers told *Technology Review* that the overriding crisis is lack of funds. Both Cambridge and Boston received this year exactly the same amount from H.U.D. as last year—$1.5 and $7 million, respectively. With inflation, this means a cutback.

The other problem they cite is priorities. "The people at our level are experiencing a high degree of frustration. It seems that the program, although well conceived, is not receiving the kind of support at the national level needed to make it work locally.

Washington is pressing for crime and violence legislation and for funds to combat drugs, they say. But why not plug these efforts into Model Cities, which is an existing, workable vehicle for bringing federal support into the most needy parts of the urban scene? Why doesn't Washington identify the Model Cities agency as the place to start for labor and business programs?

"We're not sure whether the administration is just spending the Model Cities money because it was authorized before—or whether it is really pushing for Model Cities," one worker said.

Model Cities Task Force Recommendations

A presidential task force appointed one year ago to study the federal Model Cities program finds it highly promising—but clouded by undersupport and overregulation. Following the report's publication, the Department of Housing and Urban Development, with support from other federal agencies, announced a series of "planned variations" to be tried in a dozen or so Model Cities on an experimental basis (*see left*).

But the planned variations only incorporated some of the task force proposals. They included cutting back some administrative red tape. They did not, however, put on the record *any* pledge that the program would receive better financial support.

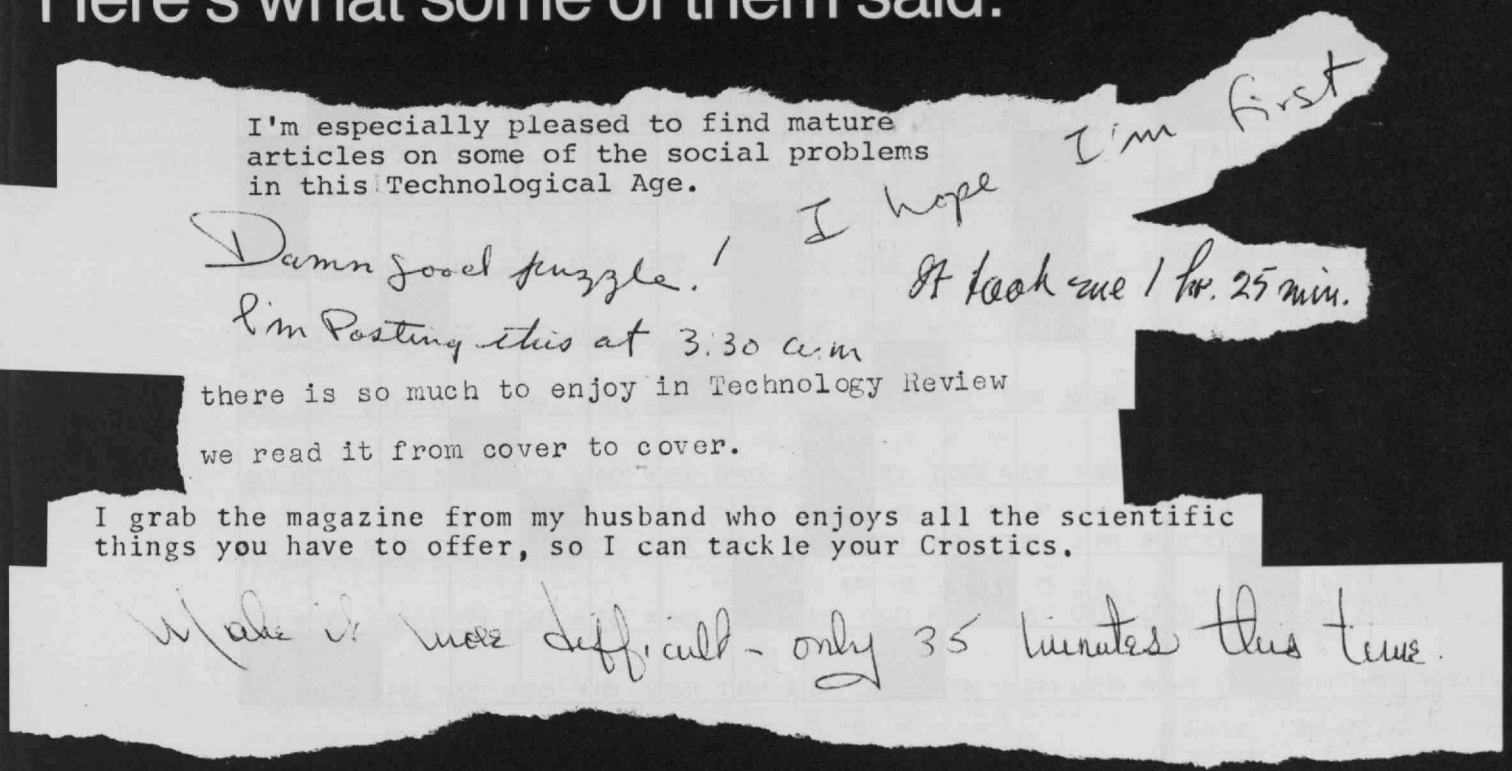
The task force, chaired by Edward C. Banfield, Henry Lee Shattuck Professor of Government at Harvard, said that federal pressure for "documents called 'plans' left too little time for project planning" in local agencies. The federal pressure to be "comprehensive resulted in the spread of small projects rather than in a concentration of effort" at the local level.

For example, the task force cited the Chicago Model Cities proposal which required 2,500 single-spaced typewritten pages, mainly because federal regulations ask for so many different documents. Instead of having to fill all these red-tape requirements, local staff should have devoted more time to better project planning.

The task force made a strong point of the financial undersupport of Model Cities to date. It was skeptical that federal agencies would "voluntarily" commit funds to the Model Cities program, as the President's Urban Affairs Council and later George Romney, Secretary of Housing and Urban Development, have both urged publicly. "The indications are," says the report, "that voluntary action will not produce anything like the support that is needed."

In addition to a number of mechanical changes in Model Cities program administration which would implement the above, the task force strongly urged the President to keep Model Cities high on the list of national priorities. The President should, it said, use his "influence with Congress" and his budgetary control to "make it unmistakably clear . . . that it is his wish that the federal government keep the promises it has made to the Model Cities."

When we asked Technology Review readers to compete for prizes in solving the October/ November Tech-Crostic, over 130 rushed to the nearest post office with their answers. Some stayed up all night; some spent 35 minutes. Here's what some of them said:



I'm especially pleased to find mature articles on some of the social problems in this Technological Age.

I'm first

I hope

Damn good puzzle!

It took me 1 hr. 25 min.

I'm Posting this at 3:30 a.m

there is so much to enjoy in Technology Review

we read it from cover to cover.

I grab the magazine from my husband who enjoys all the scientific things you have to offer, so I can tackle your Crostics.

Make it more difficult - only 35 minutes this time.

There are more than 40,000 responsive readers of Technology Review every month. They are the kind of people advertisers want to reach. Tell your advertising department or agency about Technology Review, or call us collect at M.I.T. Ask for Dick Wright, (617) 864-6900, extension 4871. Ask him for readership data, rates, and space reservations.

Tech-Crostic
David L. and Judith G. Holt

Mid-Winter Fun

								I 1	V 2		G 3	N 4	P 5	X 6	B 7	K 8		N 9	I 10	V 11	I 12
A 13		R 14	I 15	Y 16		F 17	Z 18	C 19	W 20	P 21	M 22	Q 23	A 24	S 25	Y 26	H 27		U 28			
P 29		Z 30	L 31	R 32	B 33	T 34		G 35	N 36	I 37	E 38	K 39	U 40	B 41	Q 42	L 43	V 44				
F 45	P 46	S 47	X 48	O 49	B 50	J 51		D 52	U 53	S 54		V 55	L 56	O 57	N 58	C 59	U 60				
W 61	D 62	P 63	G 64	E 65	J 66	Q 67		I 68	R 69	L 70		K 71	C 72	H 73	R 74		W 75	T 76			
	B 77	E 78	O 79	Q 80	G 81	L 82	W 83	I 84		X 85	M 86		A 87	L 88	D 89	O 90	Q 91	E 92			
S 93	H 94		E 95	I 96	M 97	V 98	P 99	A 100	T 101		O 102	Q 103	V 104	H 105		Z 106	J 107	O 108			
	D 109	T 110	A 111	I 112	L 113	B 114	G 115	R 116	Y 117		R 118	N 119	I 120		U 121	F 122	R 123	P 124			
I 125	B 126	N 127	X 128		K 129	D 130	Q 131		R 132	Y 133		C 134	X 135	H 136	S 137	U 138	E 139	M 140			
	E 141	Q 142	M 143		J 144	W 145	U 146	G 147		C 148	X 149	T 150	Z 151	F 152	K 153	Y 154					

Use the definitions at the right to help define the words to which they refer; then enter the appropriate letters in the diagram to complete a quotation from a scientific work. The first letters of the defined words give the author and title from which the quotation is taken. Black squares in the diagram indicate the ends of words; when there is no black square at the right end of the diagram, the word continues on the next line.

The correct solution to this Tech-Crostic will appear in the March issue of *Technology Review*.

David L. Holt is Assistant Professor of Metallurgy at M.I.T. He will welcome readers' comments; address him in care of *Technology Review*, Room E19-430, M.I.T., Cambridge, Mass. 02139.

A. Mouthlike opening. — 13 87 100 24 111

B. Winged, feathered. — 77 126 7 114 33 41 50

C. Ellipsoidal. — 134 19 72 148 59

D. Unit of electrical capacity. — 52 89 62 130 109

E. Bathes with warm liquid; nurses to life; rouses. — 141 78 92 139 38 95 65

F. Equalizing allowance for the disadvantaged side. — 122 45 17 152

G. Spinal column. — 3 115 35 147 81 64

H. As before. — 73 136 27 94 105

I. Arch form which is statiscally determined (comp.). — 125 68 12 84 96 15 1 37 112

10 120

J. English pianist, born 1890.

107	66	144	51	

K. Ant.

153	129	71	39	8

L. Contemporary playwright.

56	70	82	113	88	43	31

M. Form of musical composition.

143	22	97	140	86

N. At a distance within view.

9	36	119	58	4	127

O. Birds with highly specialized vocal apparatus.

57	79	49	102	90	108

P. Cord.

29	63	124	99	5	21	46

Q. Abstract.

67	131	103	142	23	80	42	91

R. Form into Word Q, for example.

14	118	132	123	116	69	32	74

S. Type of metal pin fastener.

54	93	47	25	137

T. Up to or before a time.

150	101	76	110	34

U. Prepare, devise.

146	28	60	121	53	40	138

V. Sounds with a harsh ringing noise.

104	55	11	2	44	98

W. Practical.

145	61	75	83	20

X. Forgives; restores; refers.

149	6	135	48	85	128

Y. City in the Ruhr.

16	117	154	133	26

Z. Stanch.

151	106	18	30

Puzzle Corner
Allan J. Gottlieb

Riding the Railroad

My girl and I went to visit my old dormitory at M.I.T. tonight. It still looks nice—but not as good as I remember. When I walk down the corridors I can see all the familiar faces and hear all the familiar voices. All of a sudden I feel very old and nostalgic.

Enough of this foolishness.

Two requests: please refer to problems by number, not by name; and please send in bridge problems.

Problems

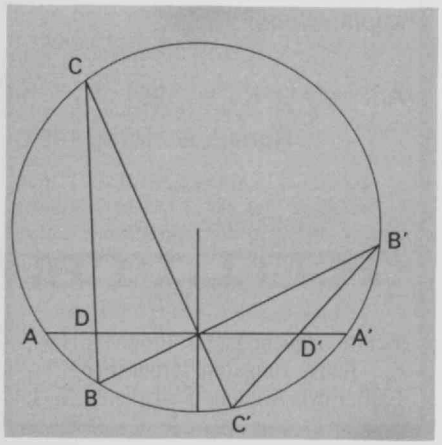
As is usual (we hope), we start with a bridge problem—this one by John Price.

16 Given the following hand:

	♠ Q x x x ♥ Q x x ♦ A K x ♣ K 9 x	
♠ 10 9 x ♥ A ♦ x x x ♣ A Q 10 x x x		♠ J ♥ K J 10 x x x ♦ J x x x ♣ J x
	♠ A K x x x ♥ x x x ♦ Q x x ♣ x x	

West opens with the ♥A and shifts to a low club. Can you make the contract—four spades?

Our second problem is from Roy G. Sinclair:



17 Let the chord AA′ perpendicular to a radius of a circle intersect the radius in M. Let any other two chords through M intersect the circle in B,B′ and C,C′. Let BC and B′C′ intersect AA′ in D and D′. Show that MD = MD′.

Russell A. Nahigian has a railroad problem (so do Long Island commuters):

18 A railroad operates under the following conditions: 1. There is exactly one train per day to take passengers from any given suburban station to any other suburban station; 2. No two trains in the same direction have more than one stop in common. 3. Each train stops at exactly three suburban stations; and 4. More than one train per day in each direction stops at each suburban station. How many trains per day are there in each direction and how many stations are there on the line?

19 Frank Rubin wants you to rationalize the denominator of

$$\frac{1}{\sqrt{2}-\sqrt[3]{3}-\sqrt[5]{5}}$$

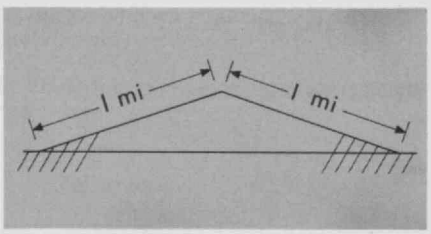
or prove it impossible.

We end with a geometry problem from Rüdiges Dierstein:

20 Construct a triangle given: 1. The bisector of side c; 2. The altitude on side c; and 3. The bisector of the angle opposite side c.

Speed Department

An easy one from James R. Bledsoe:



SD6 A car approaches a hill which is one mile long going up and one mile long down the other side. The car travels at 30 m.p.h. until reaching the summit. How fast must it descend the other side in order to average 60 m.p.h. If the total trip takes two minutes?

Solutions

1 Given the following hands, with the contract four spades:

	♠ x x x ♥ x x x x x ♦ A x ♣ A K Q	
♠ x x x x ♥ A K Q J x ♦ x x x ♣ x		♠ x ♥ x ♦ K J 10 x x x ♣ x x x x x
	♠ A K Q J 10 ♥ x x ♦ Q x ♣ J x x x	

West leads ♥K and ♥J and continues with ♥Q (his best play). Can you make the contract?

The following is from Lawrence Herman Shiller:
It is obvious that the declarer needs one more entry to his hand to cash his game-going trick, ♣J. This can be done in only one way: the declarer must ruff the ♥Q with the ♠10 and draw four rounds of trumps. On the fourth round, he must discard the ♦A from dummy. Next he cashes the ♣A, ♣K, and ♣Q and leads a low diamond to his ♦Q. If East goes up to ♦K, he will have only a diamond or a club to return and declarer's hand will be good; if East ducks, the declarer wins the ♦Q and cashes the ♣J, conceding the last trick to East. Either way the declarer makes 10 tricks, losing only two hearts and one diamond. (It is interesting to note that assuming one of North's small hearts is the ♥10, the N-S contract of three no-trump is unbeatable.)

2 Let N be some fixed positive integer. Show that there exist positive rational numbers $a_1, \ldots, a_N$ such that for any m, $1 \leq m \leq N$

$$S(m) = \sum_{i=1}^{m} a_i^3$$

is the square of a rational number, and $S(N) = 1$.

Apparently this problem was rather difficult. The only response was by R. Robinson Rowe, who seems to arrive at a dead end. In the hope that it may help someone

else, I am reprinting his partial solution: It was my hunch that the summations involved the fact that the sum of the first m cubes was the square of the mth triangular number, that is,

$$\sum_{1}^{m} i^3 = [\tfrac{1}{2}m(m-1)]^2 = T_m^2.$$

But if S(N) = 1, each term of the series (all being positive) must be less than 1, suggesting that $a_i = ki$, where k is a rational fraction. This leads to
$S_m = k^3T_m^2$,
which must be a square, so that k is a square, and to
$S_N = k^3T_N = 1$, so that
$k^3 = u^6 = 1/T_N^2$.
However, except for the trivial $T_1 = 1$, no triangular number can be a cube. So my next hunch was that $a_i = ki = u^2i$ for $N - 1$ terms, and a_N is not kN but chosen so that $k^3T_{(n-1)}^2 - a_N^3 = 1$, which depends upon solution in integers of $X^6 = Y^3 + Z^6T^2$. This may be soluble, but for the moment it is a dead end, too.

3 Pascal's triangle can also be written in rectangular form, in which case it looks like this:

1 1 1 1 1 ...
1 2 3 4 5 ...
1 3 6 10 15 ...
1 4 10 20 35 ...
. . . . .
. . . . .

The first row and first column consist entirely of 1's and the other entries are found by adding the number to the left and the number above. If this array is continued to n rows and n columns, where n is any positvie integer, prove that the determinant of the resulting matrix is 1.

The following is from Thomas H. Sadler: Let M be the nXn matrix in question. From M,I obtain a sequence of nXn matrices, $M = M_1, M_2, \ldots M_n$, such that $\det M_1 = \det M_2 = \ldots = \det M_n$, and M_n is in triangular form with all diagonal elements equal to 1. I get M_k from $M_{(k-1)}$ in the following way:
1. Rows 1, . . . , (k − 1) of M_k and $M_{(k-1)}$ are the same.
2. Row i, where i = k, . . . , n of M_k is simply row i of $M_{(k-1)}$ *minus* row (i − 1) of $M_{(k-1)}$.
Since each row of M_k is the sum of the corresponding row of $M_{(k-1)}$ and a scalar multiple of another row of $M_{(k-1)}$, $\det M_k = \det M_{(k-1)}$. Thus $\det M_1 = \ldots = \det M_n$. The rules for Pascal's triangle give us
a. M(i,1) = M(1,j) = 1, i, j = 1, . . . , n.
b. M(i,j) = M(i,j − 1) − M(i − 1,j), i, j = 2, . . . , n.
Using the procedure given earlier, I get M_2 from M:
1. $M_2(1,j) = 1$, j = 1, . . . , n
2. $M_2(i,j) = M(i,j) - M(i-1,j) =$ $M(i-1,j) + M(i,j-1) - M(i-1,j)$ $= M(i,j-1)$ for j = 2, . . . , n, i ≥ 2; and $M_2(i,1) = 0$ for i = 2, . . . , n. So the first elements of rows 2, . . . , n of M_2 are zeros and elements 2, . . . , n of each of these rows are just elements 1, . . . , n − 1 of the corresponding rows of M. Thus rows 2, . . . , n of M_2 have the relationship b. above. Now, hopefully, you see that doing this over and over results in row i of M_n having elements i, . . . , n equal to elements 1, . . . , (n − 1), respectively, of M and every other element zero. Thus M_n is in triangular form. But the determinant of a matrix in triangular form is the product of its diagonal elements. Since all diagonal elements of M_n are 1's, det $M_n = 1$. Therefore, $\det M = \det M_n = 1$.

4 A magic square is a square matrix of numbers such that rows, columns, and diagonals all sum to the same total. Create a 5 x 5 magic square using 25 two-digit numbers composed of the digits 0, 1, 6, 8, and 9. The magic square must also work when turned upside down, so that 90 becomes 06, etc.

The following is from Loren L. Dickerson, Jr., who offers two magic squares which meet the conditions specified. He writes: The magic squares below are typical of 32 that can be made by the normal knight's move, starting from various cells of the grid, and having the central number of the series, 66, centered. Any distribution of the specified digits, 0, 1, 6, 8, 9, whereby each digit appears only once in the units and once in the tens in each row, column, and diagonal will make a magic square; and any pairs of digits may be interchanged, as the 6 and 9 are when inverted. Modifications of the knight's move, if they work, should produce only reproductions in a square as small as 5 x 5. These squares are pandiagonal in that all 10 diagonals of each have a sum of 264, both right-side-up and inverted. They cannot, however, be completely associated (all pairs of cells equidistant from the center summing to 99), because there is no complement to 6 in the series of digits, and they would not be associated after the inversion, anyway.

91	68	00	86	19
06	89	11	98	60
18	90	66	09	81
69	01	88	10	96
80	16	99	61	08

18	61	89	96	00
86	90	08	11	69
01	19	66	80	98
60	88	91	09	16
99	06	10	68	81

5 Determine a rational number whose square, when increased or decreased by 5, is still a square.

The following is from Winslow H. Hartford, who writes that the problem is "a real favorite of mine, perhaps because it was proposed to me by my boss on my first permanent job in 1934. I kept the job and solved it." Mr. Hartford's answer is 41/12, the square of which is 1681/144; the other numbers are 961/144 and 2401/144, which are $(31/12)^2$ and $(49/12)^2$, respectively.

Allan J. Gottlieb, who graduated from M.I.T. in 1967, teaches mathematics at Brandeis University. Send problems and solutions to him at the Department of Mathematics, Brandeis University, Waltham, Mass 02154.

On Abstracting Human Problems

Women in Science

To the Editor:
In "Some Thoughts on Women in Science" (*see* Technology Review *for July/August, 1970*) Professor Yevick is searching for a life style which will permit a woman to have the best of all worlds. Most of the unhappy women described by her did not plan their lives or their marriages with much insight or intelligence. It is not that these women were "unfortunate"; they did not pursue their intellectual goals wisely.

Mrs. Yevick has stated two characteristics of successful male scientists: single-minded devotion to a plan of life, and the certainty that single-minded concentration will yield a harvest of ideas, competence, and excellence. These characteristics can apply to women also. Why is it that so few women plan their lives so that they can develop their interests? We can chalk it up to our culture, and there is much truth in that. But there are other specific reasons: the biological urge for marriage and motherhood; the desire for a nice home, car, and club; and the lack of agreement about goals between husband and wife, before and after marriage.

There are more options open to women today than ever before. Some options are: remain single and have no children; marry but have no children; have children after the age of 30; have children before 30 and reduce intellectual or vocational pursuits to a minimum until the youngest child enters school; or have children raised by a nursemaid and continue intellectual or vocational interests outside the home.

The intensity of desire for outside intellectual and vocational work varies with the individual. In any case, there should be agreement and compromise in marriage. The happiest women manage to do most things well. They enjoy the companionship of an understanding husband. They enjoy the miracle of birth and the molding of a young child through parental love and guidance. They enjoy keeping up with their own intellectual and professional interests.

There are some women who do not really like children, and they should avoid having children. There are some women who do not like housework, and they should avoid cleaning or sewing.

There are some successful and happy women who plan different styles of life for different periods of their lives. Here is the pattern of one contented woman: study until the age of 23; a professional career for five years; marriage and family interests for ten years; part-time study combined with family interests for five years; and professional career for 20 years.

Perhaps the fundamental question asked by Mrs. Yevick could be paraphrased as: Is it possible for a woman to be a full-time scientist and also produce a family? The happy women I know all answer in the negative. Most of them go even further and say that they have appreciated the chance to "retire" temporarily and to enjoy their young children. Could it be that the unhappy women known by Mrs. Yevick made a series of poor choices?

Warren Himmelburger
Wellesley Hills, Mass.

To the Editor:
Although I am not a woman in science, I am an M.I.T. alumna ('68) in City Planning (M.C.P.) and am very close to getting a second Master's at M.I.T. in management.

It was only M.I.T.'s willingness to permit a part-time schedule (while my children were in the early primary grades) that enabled me to get a firm foundation for the start I have made in business. Not all schools are willing to permit part-time graduate study, and even at M.I.T. a part-time arrangement is difficult to come by. But how else to do it?

Eventually, I was able to carry both a full-time graduate load and a job as a city planner. However, after several years of this overwork I find I really don't have that much extra energy; so I am back to part-time studies again, plus full-time building of my business.

The reason for the full-time work was the financial problem of graduate school, babysitters, and housecleaners. The part-time program alone is not sufficient: we need financial aid for part-timers, too; and this is extraordinarily hard to come by. Also, a tax allowance for sitters.

Just thought I'd mention another variation that can work for women, although I imagine it is the rare woman who can hold down job and graduate school simultaneously. It requires a good deal of self-sacrifice and cooperation from her family.

Riva M. Poor
Cambridge, Mass.

The writer is a partner in Bursk and Poor, Publishers, of Cambridge, Mass.—Ed.

To the Editor:
I am just getting my Ph.D. in mathematics after four less than pleasant years in graduate school and have been bothered by the prejudice I have encountered.

During the past year it has become clear to me that women in science face two types of difficulties which are not really intrinsic and might, in theory, be overcome with some community action. First, there is the feeling that there is no one to turn to in case of professional or personal difficulties. The scarcity of women in scientific fields makes each woman (and especially each woman student) feel alone. The fact that there are even fewer women in higher positions adds to the difficulty of finding a woman from whom to seek advice. Second, many male scientists, who in most ways are reasonable and sensitive human beings, simply do not know how to treat women scientists, nor do they understand the problems women face.

As a partial solution to the first problem, it might be useful to arrange periodic get-togethers for women scientists and students (particularly in the same field), where problems can be discussed and people can meet. Of course, there is always the danger that these things become very boring, so that it would probably be best not to have them so often. More important, it would be useful for established women scientists (or at least post-docs) to make themselves available to talk to younger women who are in need of professional advice.

The problem of educating our male colleagues is even more difficult. There will always be those who believe that women's place is anywhere except in science, but I have encountered many borderline cases who are merely ignorant and confused. The current women's lib movement is making them much more aware, but something else is needed. Perhaps a sort of Guide to Treating Women Scientists and Science Students, written by women scientists explaining how they would like to be treated and why, would help in this direction. (It might at least prevent remarks like "What are you going to do now, continue in mathematics or raise babies?" as was recently asked me.)

Linda Preiss Rothschild
Medford, Mass.

The writer is a member of the faculty in the Mathematics Department of Tufts University.—Ed.

To the Editor:
The crucial requirement for a fruitful career in science is a keen interest and devotion to one's field of study. If the individual has talent too, so much the better. The scientist's sex has no bearing on that point. Women should not be willing to even consider taking a few years off while the children are small. Even when working full time, it is extremely difficult to keep up with developments in one's field.

What is the answer, then, for women who want to be scientists and also live normal lives with a husband and children? Most important of all is their choice of husband! He must take his wife's professional interests as seriously as his own and as seriously as she takes his. He cannot consider his own career as the only one which deserves attention. When selecting employment both careers must be taken into account.

Financial sacrifices are unavoidable, especially at the beginning of a wife's career when it is necessary to pay domestic help while the children are small. One is fortunate indeed, if the mother's salary covers all the added household expenses. In my own case this was not the case for some time.

In my field of crystallography there are many women from different countries who have made a go of their careers, including one Nobel Prize winner, the first woman president of the British A.A.S., and the first female member of the Dutch Academy. We talk shop with one another when we meet at congresses and enjoy doing so. Let us not find excuses for ourselves and differences between the sexes where there are none.

Gabrielle Donnay
Montreal, Canada

The writer is Professor of Crystallography in the Department of Geological Sciences at McGill University.—Ed.

Mrs. Yevick comments:
The lack of sensitivity which Mrs. Rothschild notes in some of our male colleagues (and with which I am most familiar), is, I believe, frequently the result of a life of single-minded devotion to abstract pursuits, which inclines one to evaluate human and emotional problems in merely abstract and logical terms. I have often noted the same simplistic tough-mindedness in matters psychological among women scientists of the older generation who fought their way to success in an almost exclusively male world.

The woman scientist who is also a mother is fortunate enough to experience the softening due to a constant concern with the inner needs of other human beings. Let us not lose this sensitivity as we travel the road toward equality in the professions. Let us rather aim to share it with our partners. Not all of life's variables are subject to conscious scientific control. Young people of 20 or even 25 cannot foresee with due precision whether or not they are choosing the "right" partner, nor whether it will be possible or desirable to surrender their children to full-time housekeepers. While we restructure our institutions to be more in harmony with our goals, let us feel free to make allowances for others and ourselves in succumbing to life's unpredictable contingencies.

Intelligence or Curiosity?

To the Editor:
If one aim of the *Review* is to interpret science as a culture to concerned citizens, you should not give space to the controversy over the origin of the universe ("Big Bang or Steady State"—June, 1970) without explaining that such arguments are merely the astronomers' equivalent of "goofing off"—that the "big bang" boys can't account for the prehistory of the assumed explosive—that the "steady state" boys can't really conceive of time being infinite—but that a columnist is obligated to fill his space, and if there's nothing explosive to report, he falls back on the inscrutable.

Let Mr. Cowen address himself to the question of what difference it makes, if any, if either theory is correct. Intelligence—the ability to solve the problems of the future—is essential to the survival of human civilization and its institutions; but curiosity is not an acceptable substitute for it.

Edward N. Horr
Hickory, N.C.

Mr. Cowen observes:
I always thought scientific curiosity was of the essence of intelligence. As Harlow Shapley has noted, small, "insignificant" man embracing a big, awesome universe in thought is neither insignificant nor presumptuous. Indeed, it reflects the magnificence of the universe on a human scale.

On Professional Roles

To the Editor:
Professor Schein's article, "The Role Innovator and His Education" (*see* Technology Review *for October/November, 1970*), seems to be a partial answer to a larger question. Education for role innovation will free professions but it will not free clients.

The question I am concerned with is our dependence on professionals. Even with the most innovative professionals, Professor Schein's thrust will still leave us dependent on psychiatrists, lawyers, and architects to solve our problems. We will still accept their definition of a "good" solution because they are "authorities."

It seems to me that the problem is inherent in the role of the professional. We expect deference to our solutions rather than use of our competence to further the expressed interest of the client, if indeed the client expresses any interest.

I am not sure how to break this dynamic, but I think it may have something to do with breaking the notion of an elite which is inherent in the training of various professionals.

Richard McDowell
Waltham, Mass.

Pollution Economics

To the Editor:
In "Washington vs. Pollution: Blockbuster or Egg?" (see *Technology Review* for December, 1970) Victor Cohn suggests a "national energy policy" that might prefer glass containers to metal or plastic ones on the grounds that less critical resources—electric power and scarce minerals—are used in their production. If you will pardon an exposition of basic economics, such considerations are already being given their proper weight.

The free market puts a price tag on everything, based on its availability and the need for it. The cheapest way of doing a task is automatically the way that uses the least amount of scarce resources. As conditions change the cost of various methods will change. If the supply of critical minerals becomes insufficient, the cost of containers made with them will rise. Whenever glass containers are more expensive than metal ones, however, it is wasteful of scarce resources to use them.

If Mr. Cohn believes that critical minerals are running out and thus deserve higher prices, he is only speculating. A convinced speculator may put his money on the line and stockpile reserves. If he is right, he will one day be richly rewarded. But he may be wrong. The T.V.A. believed that coal was not worth the price asked for it last year and now is forced to pay far higher prices since it has no reserve.

Exhaustion of resources is a factor that is properly accounted for in our economic system. Some human factors, however, are not. The cheapest way of solving a pollution problem is to persuade the appropriate official to ignore it. While this solution is available, no one can afford not to try it. The San Francisco sewage system is just as guilty of this as U.S. Steel. I am sure most people will agree with me that such a method of saving money is intolerable, even when it is our money. (It always is our money, since we pay for the sewer systems and the steel products.

Mr. Cohn envisages a future in which tax money will be used to clean up the messes we make, and national policy makers will endeavor to keep us from making new ones. Since individuals rarely take the advice of national policy makers, I foresee an elaborate network of enforcement officials as well as the spending bureaus. I think the cost should be assessed to the offenders, not the public tax rolls. If someone makes a mess, let him pay for cleaning it up. Then the forces of economics will work on the side of humanity, and national policy makers will be unnecessary.

I hope that the effort and intelligence now being applied to improving life in the United States can be directed toward these human problems that have never been solved, instead of the economic problems that are being solved every day.

E. Alan Phillips
Berkeley, Calif.

The Politics of Unemployment

To the Editor:
I am writing about the article "Last Pass at the Only Game in Town" by Mr. Osinski, a laid-off Boeing engineer (see *Technology Review* for December, 1970).

I am a Boeing employee who believes that the article was inaccurate in its description of the working environment at Boeing and the work produced. In addition, I think that Mr. Osinski's criticism of the 747 schedule and manloading plan demonstrates the typical humanist's lack of knowledge of how to produce an end-product at minimum cost, rather than just spend money.

If the Boeing Co. is to be criticized, it should be for overconcern for its workers and the community, in that lay-offs of people working on follow-on airplanes were not begun earlier when technical difficulties were first encountered on the 747 and the company's money was required to fix them.

If the aerospace industry which produces useful products is to be criticized as being evil for not having the knowledge to create new technology products at a sufficiently low price, surely we should be criticizing other fields for an inadequate state of the art. We might accuse social workers of not decreasing poverty. We might accuse university administrations of not maintaining an academic environment or even sometimes not completing the school year, not to mention the overseeing of a deepening university financial crisis. At least the state of the art in aerospace is improving.

I do not think *Technology Review* should be a political magazine. This article is but one example of a long line of biased reporting.

I think you should get a new editor.

Richard Hardy
Seattle, Wash.

Crostic Comments

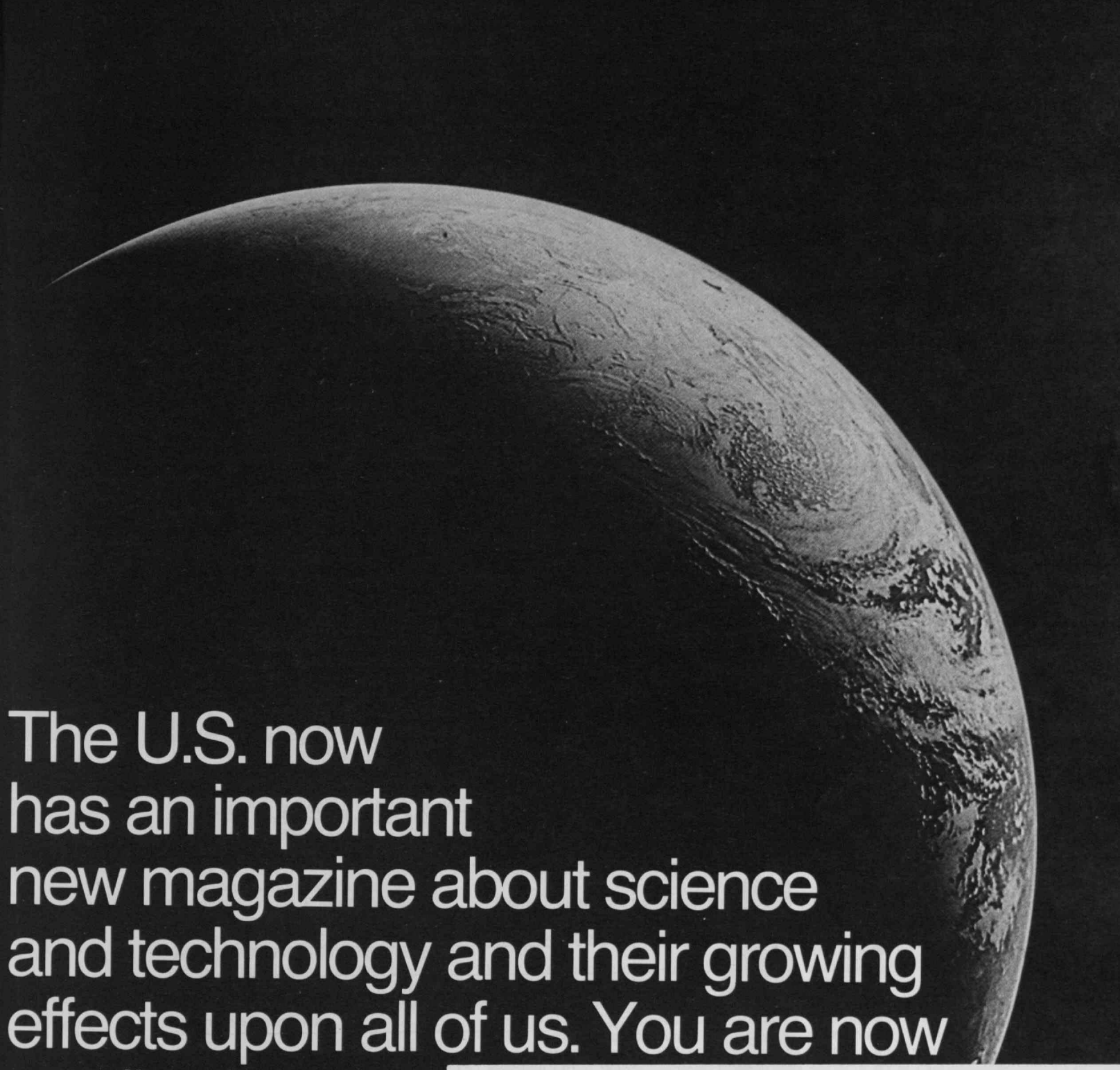
To the Editor:
I could comment that your series of Tech-Crostics is unfair to older alumni in disciplines other than its authors' and suggest a sprinkle of quotes and cues from classical texts in, say, civil engineering, such as *Surveying* by Breed and Hosmer or *Theory of Structures* by Spofford.

But I won't. I would learn nothing by solving such an acrostic. On the other hand, I learned tonight something about calx, cetin, lipid, amine, and -ose (I already knew about riboflavin). So by unravelling a test biased to an unfamiliar discipline, there was a fringe benefit.

R. Robinson Rowe
Sacramento, Calif.

January Tech-Crostic Solution

"We conceive of the cognitive system as the data processing unit of the organism. It constitutes the translational unit wherein the stream of incoming signals is first interpreted and later stored.
—R. G. Smith, *Speech-Communication*



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TR-71

Institute Review

On Choosing the President: More Ennui than Discontent

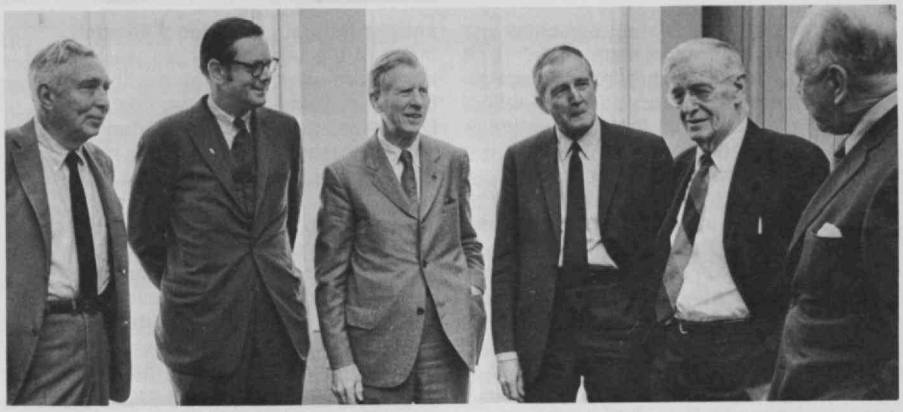
Though there is intense activity and a major commitment of time and effort by those involved, the process of choosing a new President for M.I.T. looks a little like the process of simmering oatmeal on the stove: only an occasional bubble of excitement reaches the surface. The best guess seems to be that a nominee may be presented for approval by the Corporation as winter begins to give way to spring.

Paul V. Keyser, Jr., '29, President of the Alumni Association, says the Corporation Committee on the Presidency—of which he is a member—has been conducting an "energetic process of review" with members of the faculty, C.J.A.C., and administrative officers. It is clear that members of the Corporation Committee are devoting prodigious amounts of time to their assignment of evaluating the Institute's Presidency and the qualifications of men who might fill it—and they admit that they the task not a simple one.

Patrick M. Hurley, Ph.D.'40, Professor of Geology who heads the Faculty Committee on the Presidency, has received over 3,000 pieces of mail from the faculty; the Committee has polled the faculty extensively, including a telephone poll of senior faculty; has met every week during the fall term; and has obtained what Professor Hurley calls an "enormous" response.

The Corporation's Joint Advisory Committee on Institute-Wide Affairs (C.J.A.C.), which provides the principal route for public community discussion, is not speaking of names in its open sessions. But at C.J.A.C.'s last open meeting, early in December, a student member noted that the list of candidates is being narrowed on the basis of intensive research by members of the Corporation committee (and of its faculty counterpart).

Is its refusal to talk names the reason for C.J.A.C.'s failure to involve the M.I.T. student community in a lively dialogue? Perhaps; but other issues—the qualifications of the man, the selection process,



The future is in their hands: six members of the Corporation Committee on the Presidency took time from their deliberations this winter to pose for Technology Review*'s photographer; they were (left to right) Paul V. Keyser, Jr., '29, President of the Alumni Association; Jeptha H. Wade, '45; George W. Thorn; James B. Fisk, '31, Chairman of the Committee; Vannevar Bush, '16, Honorary Chairman of the Corporation; and Julius A. Stratton, '23, President Emeritus of M.I.T. Not present for the picture: Carl M. Mueller, '41, and Uncas A. Whitaker, '23.*

and the character of the job to be filled—remain. Yet no C.J.A.C. open meeting has attracted more than ten students and faculty, not counting those who were there as reporters and/or official observers.

"There is incredible apathy on campus here," said one C.J.A.C. student member at the open meeting of December 10.

What about the community's specifications for the new President? He must be imaginative, flexible, and creative, said Gregory Smith, '30, C.J.A.C. Chairman, at the Committee's open meeting on December 10. He must make "a philosophical rather than a pragmatic commitment" to the job. And he must realize that, however we hope to insulate him from it, "crisis management" will be part of his work; no one else can do it. He must meet faculty and students openly and responsibly; and he must "recognize the dangers of politicizing the university" while separating from this its public service responsibilities.

To this list Randolph B. Hawthorne, '71, who as a C.J.A.C. member chairs a student subcommittee, added a few of his own: the new President must have "high intellectual caliber," "vision of new directions for M.I.T."; "must put good men in the right place, must build his own team"; "must recognize financial needs . . . must possess good administrative ability . . . must delegate responsibility . . . must be articulate in speech and writing."

He must have "intuition" of the M.I.T. community, said Mr. Hawthorne, but this does not mean that he has to come from within M.I.T. "A significant number" of students feel he should, as many that he should not.

What about the President's job? Don't oversimplify that discussion, said John M. Wynne, Vice President, Organization Systems: "you cannot delegate the ultimate responsibility. . . . Last year many issues were in the Provost's field and yet that didn't insulate the President." C.J.A.C. itself, said Mr. Hawthorne, has concluded that detailed recommendations are inappropriate. "The man who comes in will make his own decisions," he said. "We want a man who will build his own structure."

Yet, said Hayward R. Alker, Professor of Political Science who is a C.J.A.C. member, "the problem is such that an impressive man is not the whole solution." Among his suggestions: give students and faculty "a voice" in choosing mem-

Speaking to members of the Alumni Fund Board late last fall, James R. Killian, Jr., '26, Chairman of the M.I.T. Corporation (center), said the Alumni Fund, having made "enormous progress" since its founding in 1940, is now of "immense significance" to the future of the Institute. This is especially true, he said, as the Institute enters "a period of very grave financial problems."

bers of the Corporation, and somehow specify that Corporation members "should be younger and more representative of on-campus views. . . . The 'public interest' membership of the Corporation should be expanded," and its relationship to the President changed so that he "is not solely the creature of the Corporation; it is more important that the President have a close relationship to the students," said Professor Alker.

Is M.I.T. really satisfied with the presidential selection machinery? It's important, said C.J.A.C. member Jerrold M. Grochow, a graduate student in management, that the new President "not be hampered by any feeling that the community did not adequately enter into his choice." Though some sought to criticize the embargo on public discussion of nominees by name, the silence looks more like boredom than discontent.

Pitting Alumni Giving Against "A Confluence of Forces"

Despite the "sense of responsibility and devotion" of many alumni, a "confluence of forces now jeopardizes the future of our private institutions," James R. Killian, Jr., '26, Chairman of the M.I.T. Corporation, told the Alumni Fund Board at its regular fall meeting in November. "To mobilize opinion and effort in support of American private institutions is now an acute national problem," he declared.

Indeed, said Dr. Killian, the encroachments on their strength and on their capital which are now being forced on some private universities may mean that their "cutting edge is already dulled."

Dr. Killian cited several factors now working against such private institutions as universities, museums, foundations, and hospitals:

◇ Federal tax policies threaten to make large gifts to such institutions increasingly difficult. Proposals for the Tax Reform Act of 1969 (*see* Technology Review *for October/November, 1969, pp. 93-94*), though not fully enacted into law, suggested rising opinion in Congress and the federal government against many of the tax advantages which have heretofore been associated with major gifts to private institutions; now, said Dr. Killian, there is some evidence of similar threats to the tax-free status of gifts coming through bequests.

◇ There is no major commitment in national policy to the vital role of private as distinct from public institutions. People fail to understand, said Dr. Killian, that private museums, hospitals, and colleges are important to the success of public institutions through the "freedom and flexibility" which they provide. Our present system of private and public universities, for instance, offers "greater strength" than could either type of institution isolated from the other.

◇ Recent campus developments have "enormously complicated" the problems of private institutions in finding the support they need. Some citizens (fortunately only a few so far), for instance, said Dr. Killian, have become distrustful, of the freedom of private institutions and believe that they should come under public control.

If these constraints can be overcome, Dr. Killian assured the Alumni Fund Board, there are sufficient private resources in the U.S. to maintain fully the strengths of both private and public sectors of American higher education, and he emphasized the role which alumni can play in this effort. Indeed, he challenged the Alumni Fund Board to "so arouse our constituency that we can make a significant demonstration against the national trend"; it would require, he said, "an immense and dedicated effort."

The fact that the 1971 Alumni Fund is ahead of last year in both the number of donors and the amount of their giving "says something enormously important to us," Dr. Killian told Howard L. Richardson, '31, Vice-Chairman of the Alumni Fund Board, and his colleagues attending the meeting. But against this optimistic report he cited M.I.T.'s increasing financial problems which result, he said, in "the real possibility of deficits for the first time in my experience at M.I.T." Among these are such "flabbergasting" inflationary pressures as these two examples from the Institute's experience in the fall of 1970: a $400,000 increase in the cost of Blue Cross and Blue Shield benefits already assured by M.I.T. to faculty, staff, and employees; and a similar $400,000 increase in the cost of heating fuel, deriving from an increase in oil prices and from the Institute's insistence on more expensive low-sulfur oils.

Eighty per cent of the private philanthropy in the U.S. now comes from private individuals, said Dr. Killian. "The potential for substantial private support exists; the problem is to persuade these potential donors—and all Americans —that this is now a critical time" in which their gifts can have special relevance.

Protest by the Faculty: Rights and Responsibilities

Following its approval of a plan for inquiring into academic staff participation in the 1970 occupation of the offices of the President and Chairman (*see* Technology Review *for January, 1971, p. 99*), the M.I.T. faculty has entered into its permanent records a resolution that "no member of the academic community can . . . legitimately claim a right to obstruct or prevent any other member of the community in the exercise of his rights, or interfere with the community's educational process or with the operation of its facilities."

The resolution assures all members of the community of the right to protest: "rallies, demonstrations, picketing, the circulation of petitions, and other forms of peaceful protest . . . constitute a vital part of the machinery by which disagreements may be registered and attention drawn to possible new directions. . . . and they shall not be interfered with or obstructed.

"(But) it is equally clear that some restraints must exist on protest activity if the core freedoms of the academic community are to be preserved," and recognition of these "is a necessary aspect of the duties and responsibilities entailed in the acceptance of membership in the academic community."

The wording of the resolution was drafted by the Staff Section of the Staff-Administration Committee chaired by James A. Fay, S.M.'47, Professor of Mechanical Engineering, as part of interim rules proposed for addition to the Rules and Regulations of the Faculty. Discussion in the faculty meeting focussed on the need for a statement of principles; for example, Jerome Y. Lettvin, Professor of Communications Physiology, held that codification of common law tends toward repression and the suppression of individual judgment, and Salvador E. Luria, Sedgwick Professor of Biology, proposed that specifics which might be listed in any code were in fact subsumed under the statement of general principles represented by the resolution.

Urban Research Funds

A $1.5 million supplementary grant for support of the Urban Systems Laboratory and other activities relating to research and teaching on urban problems has come to M.I.T. from the Ford Foundation; it is an extension of the program under which the Urban Systems Laboratory was originally founded with Ford Foundation funds at the Institute in 1968 (*see* Technology Review *for January, 1968, p. 64*).

The new funds will support new urban-oriented courses in the School of Architecture and Planning and the Department of Political Science as well as interdepartmental research through the Urban Systems Laboratory, and postgraduate training for urban executives is also included, according to the Ford Foundation announcement.

Gourmet in Academe

With renewal this winter of the fitful discussion between students and administration of "commons" meals in M.I.T. houses, *The Tech* asked David B. Searls, '73, to make an "in-depth" study of Boston-area college dining services. He did so, rating the meals he thus ate on a scale of 1 to 5, and asking the more regular patrons of the same services to rate on a similar scale the quality of food and service which they experienced.

The results: Wellesley offered "what I thought was some kind of breaded sea food (which) turned out to be veal cutlet"; but the dessert (peppermint fudge pie or pineapple upside down cake—your choice) "nearly redeemed the meal." Score: 2; the students' ratings were 2.1 for food and 3.1 for service.

Searls was "shocked" when he tried Boston University's food—"a marked lack of any sort of flavor"—and ended up rating it 2. Students' ratings were 2.8 on both counts. At Boston College there was a choice: roast beef, fish, or liver, and several vegetables, which earned a rating of 4 from Searls but only 2.8 from the B.C. students with whom he talked; their complaint, he said, "was that steak is not being served as often as last year (once a week)."

But the Harvard Union dining hall took the cake, with "exquisitely done" roast beef, broccoli, baked potato, French bread, and green salad; the rating was 5—"completely satisfactory"—and Harvard students themselves gave their food 3.9, their service 3.6 on the 1-to-5 scale.

M.I.T.'s rating? Not specified.

Computer-Based Library Support

The Council on Library Resources has made a $400,000 grant—the fifth since 1967—to support experimental operation of the computer-based technical library developed by M.I.T.'s Project Intrex.

After several years of development under grants from the Council on Library Resources, the National Science Foundation, the Carnegie Corporation, and the Independence Foundation, the Intrex library system is now operating from remote display consoles in M.I.T.'s Barker (Engineering) Library and Center for Materials Science and Engineering. It contains a base of detailed catalog data and microfilm texts of more than 12,000 recent articles in materials science and engineering, and at least 400 new articles are being added upon publication each month. The new grant will make possible further development and improvement of the system while it is in use by engineering and science faculty and students for their own library purposes.

The Intrex program is directed by Carl F. J. Overhage, Professor of Engineering who previously headed M.I.T.'s Lincoln Laboratory. The prototype system now in operation was developed by the Electronic Systems Laboratory under the direction of J. Francis Reintjes, Professor of Electrical Engineering.

Advanced Engineering Study

Twenty-six engineers—including four alumni—last month reached the half-way point in their "back-to-school" programs in the M.I.T. Center for Advanced Engineering Study's Practicing Engineer Advanced Study Program.

In addition, seven government officials are attending a similar "refresher" program for midcareer government officials conducted under the same auspices.

Members of the Practicing Engineer group plan individual programs of study using all the academic and research resources of M.I.T. In addition, they participate in a seminar series and other special events arranged especially for the Center for Advanced Engineering Study. In general, according to Harold S. Mickley, Sc.D.'46, Director of the Center, they are men with "senior technical responsibility and a major role in generating new technology for development within their organizations."

The four alumni in the Practicing Engineer Program are Jiro Adachi, C. E.'53, Acting Chief of the Structural Mechanics Division, Army Materials and Mechanics Research Center; Melvin M. Cerier, '52, Technical, Manager of the Communications Systems Division, Sylvania Electric Products, Inc.; Gaetano Falabella, Jr., '49, Deputy Director of the Airdrop Engineering Laboratory, U.S. Army Natick Laboratories; and James P. Rasmussen, N.E.'55, of Winchester, Mass.

The program for federal government officials includes studies built around a core based on cost-benefit analysis, planned program budgeting, and systematic policy analysis. Many members of both C.A.E.S. groups attend a special course in the fundamentals of computer operations and programming developed by the Center.

MacGregor House, M.I.T.'s newest undergraduate residence, is home for over 300 undergraduate men this year—a new landmark on M.I.T.'s skyline. For dedication ceremonies late this fall, the residents were hosts to principals from all parts of the Institute community—including James R. Killian, Jr., '26, Chairman of the M.I.T. Corporation (center, left), and Angus N. MacDonald, '46, of the Corporation Development Committee (bottom, left). There were pipers in honor of Mr. MacGregor (who was himself unable to attend), uncommonly good food, and after-dinner remarks by Howard W. Johnson, President of M.I.T. (Photos: Gerard J. Boetje and Margaret Foote)

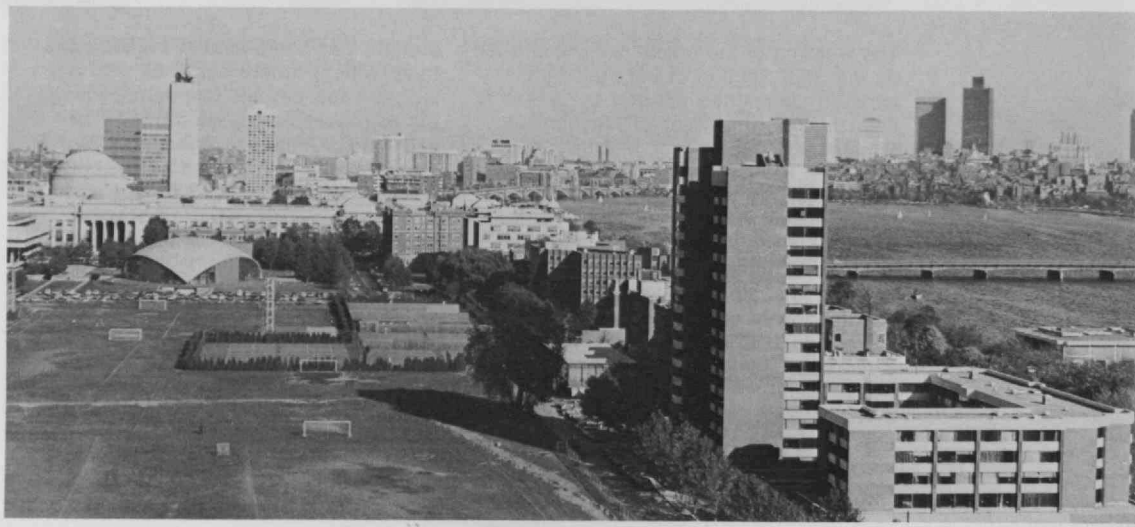
MacGregor House: "An Environment of Quality"

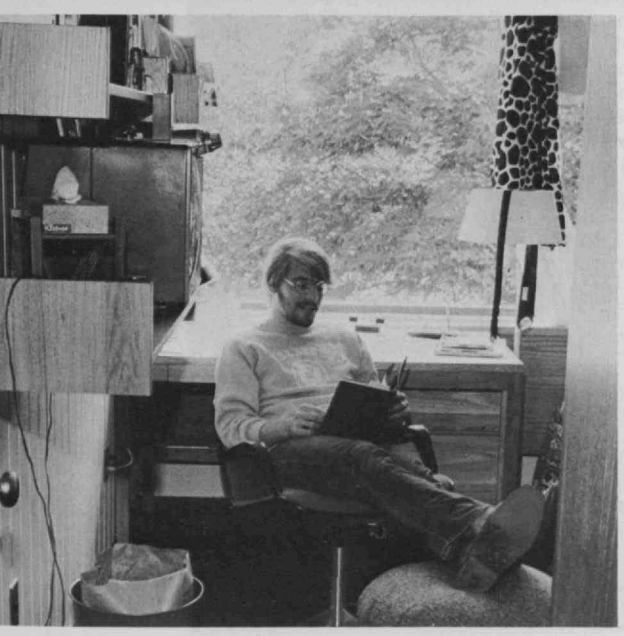
A family party for 324 residents of MacGregor House, members of the Corporation Development Committee, and many faculty and staff and their guests celebrated the completion of the House as the newest element of the Institute's housing system on November 5. Only Frank S. MacGregor, '07, himself—whose generous contributions made the House possible—was absent, being unable to make the trip from North Carolina.

In his absence, James R. Killian, Jr., '26, Chairman of the Corporation, recalled Mr. MacGregor's "extraordinary range of interests and deep and continuing sense of curiosity." Even as a student—when he was a contemporary of Katharine M. Dexter, '04, who later as Mrs. Stanley McCormick provided funds for the Institute's gracious women's dormitory—Mr. MacGregor demonstrated these talents, said Dr. Killian: "He could find his way through the regulations and bureaucracy of the Institute to get where he wanted to go."

In accepting the building, Howard W. Johnson, President of M.I.T., stressed the role of students themselves in planning the new facilities. "No house at M.I.T. has been so studied and planned by its residents," he declared, praising them and the architects for "their unremitting insistence on an environment of quality." Then came a special tribute to Kenneth R. Wadleigh, '43, Vice-President: "Perhaps more than any other he (as Dean of Student Affairs) was the one who worked on this house and the one who pressed for its accomplishment when the going got rough."

Some of the roughness is hardly yet forgotten. The students in his audience chuckled when President Johnson symbolically accepted the keys to McGregor House—because most of them still lacked keys of their own. Construction delays, mostly occasioned by strikes, meant that MacGregor House was in a semi-finished state at the beginning of the fall term when many undergraduates arrived to move in. Some found temporary quarters elsewhere and others shared their rooms in MacGregor with workmen for nearly two months.





But that is mostly over now, and it was hard to find residents with harsh things to say for MacGregor House on November 5.

The House consists of a 16-story tower and a quadrangle of four stories, all built around a central courtyard. Accommodations, mostly single rooms, are grouped into suites for six to eight men, each with its own living room and kitchenette: and the suites, in turn, are grouped into nine "entries," with each of which is associated a larger living room and a tutor's apartment. The "entries" are connected by an arcade around the quadrangle and by elevators in the tower, and at the courtyard level are a dining room and kitchen, large commons room, library and seminar room, and other recreational facilities.

MacGregor House was designed by Pietro Belluschi, Dean Emeritus of the M.I.T. School of Architecture and Planning, in collaboration with The Architects Collaborative of Cambridge. Its House Master—whose apartment also opens off the central arcade—is Nathan H. Cook, '50, Professor of Mechanical Engineering. Ernest G. Cravalho, Associate Professor of Mechanical Engineering, serves as Senior Tutor; he and Mrs. Cravalho occupy an apartment surmounting the MacGregor tower, 16 stories above Briggs Field and commanding a spectacular view of M.I.T. and Boston.

Sea Grant Projects

A Sea Grant Project Office, to serve as a focal point for M.I.T programs having a common interest in ocean utilization and coastal zone development, has been established at the Institute, and Alfred A. H. Keil, Head of the Department of Naval Architecture and Marine Engineering, has been named its Director.

M.I.T. received in 1968 the first project grant awarded by the Sea Grant Program, which itself was authorized by Congress in 1966 to enable the National Science Foundation to support education, research, and advisory services in the development of marine resources; M.I.T.'s first grant was for the preparation of a curriculum in ocean engineering in which 26 graduate students are now enrolled.

Other Sea Grant Program support has been at M.I.T. for research and teaching on ocean utilization, coastal zone development, estuary modelling, and ocean transportation. Future programs are expected to involve waste disposal, pollution control, mineral resources, and power development, according to Professor Keil.

Dean A. Horn, Nav. E. '49, formerly Head of the M.I.T. Department of Naval Science, will serve as Executive Officer of the Sea Grant Project Office, and a Sea Grant Council of members of the faculty has been formed to select program proposals and guide projects.

Reactor Improvements

The M.I.T. Department of Nuclear Engineering has applied to the U.S. Atomic Energy Commission for permission to make modifications in the M.I.T. Reactor to increase the availability of high-energy neutron flux for scientific experiments. No changes in the power level, shielding, control instrumentation, or heat exchangers are involved.

At present the neutron flux at the center of the core of the M.I.T. Reactor, where radioactive isotopes are made for many purposes including use in Boston-area medical hospitals and research programs, is three times larger than the flux at the edges of the core, where most scientific investigations are conducted. After the redesign, the full flux presently available at the center of the core—some 7×10^{13} neutrons/cm.^{2}/sec.—will become available as well at the ends of the beam ports around the periphery of the Reactor core, thus markedly improving the reactor as a scientific tool.

The change will be accomplished by making the core more compact, by using ordinary (light) instead of heavy water as a coolant and moderator, and by employing heavy water as the primary neutron reflector. Modifications will require about three months, during which the M.I.T. Reactor will be shut down; A.E.C. approval of the request is expected by midsummer of this year.

Paul E. Gray, '54

R. W. Mann, '50

E. P. Gyftopoulos

A Notable Teacher Becomes Dean of Engineering

Paul E. Gray, '54, who has been Associate Provost and Class of 1922 Professor in the Department of Electrical Engineering, has been named Dean of the School of Engineering—a major post in M.I.T.'s academic administration.

He succeeds Raymond L. Bisplinghoff, who resigned as Dean and is on leave of absence from the faculty while serving as Deputy Director of the National Science Foundation.

Jerome B. Wiesner, Provost, announcing Professor Gray's appointment, described him as "one of the leaders in the continuing development of the undergraduate curriculum, particularly the curriculum offered to students during their first two undergraduate years." Professor Gray's primary responsibility as Assistant Provost (1967 to 1969) and Associate Provost (since 1969) has been for the coordination and development of the undergraduate curriculum and, in particular, the treatment of freshman academic work as a coherent program.

In addition, Professor Gray has been Chairman of the Task Force on Educational Opportunity, a faculty and student group concerned with the expansion of educational opportunities at M.I.T. for blacks and members of other minority groups. He will continue in this assignment as Dean of the School of Engineering.

Professor Gray has been in charge of various core subjects in the Department of Electrical Engineering during his M.I.T. career, and he has "pioneered in many new procedures in the methodology now employed in these subjects," Dr. Wiesner said. He became Class of 1922 Professor in 1968—a chair established by the Class "for the purpose of rewarding and encouraging superlative teaching." Ten years earlier, as an instructor in the Department of Electrical Engineering, he had received his first award for excellence in teaching.

Professor Gray came to M.I.T. from Newark, N.J., with the Class of 1954, and he continued for graduate degrees (S.M. 1955, Sc.D. 1960) in the Department of Electrical Engineering. He served in the U.S. Army from 1955 to 1957 and then was instructor before being appointed to the faculty as Assistant Professor of Electrical Engineering in 1960, upon completion of his doctorate.

Because of his interest in undergraduate education, Professor Gray was named Chairman of the Freshman Advisory Council in 1964 and Associate Dean of Student Affairs in 1965, meanwhile continuing as Associate Professor (1964) and Professor (1967) of Electrical Engineering. His professional work has been in the field of semiconductor electronics, where he is the author and co-author of seven books, including a major text on electronic principles. He is active in the Institute of Electrical and Electronics Engineers and in addition is a member of Eta Kappa Nu, Tau Beta Pi, and Sigma Xi.

Germeshausen Professor

Robert W. Mann, '50, who has been a member of the M.I.T. Department of Mechanical Engineering since receiving his S.M. degree from the Institute in 1951, has been named Germeshausen Professor, a chair which emphasizes the combination of humanitarian advances with technological progress.

In his announcement, President Howard W. Johnson cited Professor Mann's role "as a leader in increasingly successful efforts to apply modern technology to helping the blind, deaf, and physically handicapped." This included Professor Mann's part in developing the "Boston Arm," a cybernetic prosthesis for persons with above-elbow amputations; his leadership in applying computer techniques for braille printing and translation; and his invention of mobility, recreational, and vocational devices for the blind and deaf-blind.

The Germeshausen Professorship was established at M.I.T. in 1968 by Mr. and Mrs. Kenneth J. Germeshausen ('31); Mr. Germeshausen is Chairman of the Board of EG&G Co., Bedford, Mass. Professor Mann came to M.I.T. as an undergraduate from Brooklyn, N.Y.; he is the founder of the M.I.T. Center for Sensory Aids Evaluation and Development and is Chairman of its Steering Committee.

Ford Professor

Elias P. Gyftopoulos, who has been a member of the M.I.T. faculty in the field of nuclear engineering since receiving his Sc.D. at the Institute in 1958, has been named M.I.T.'s eighth Ford Professor of Engineering.

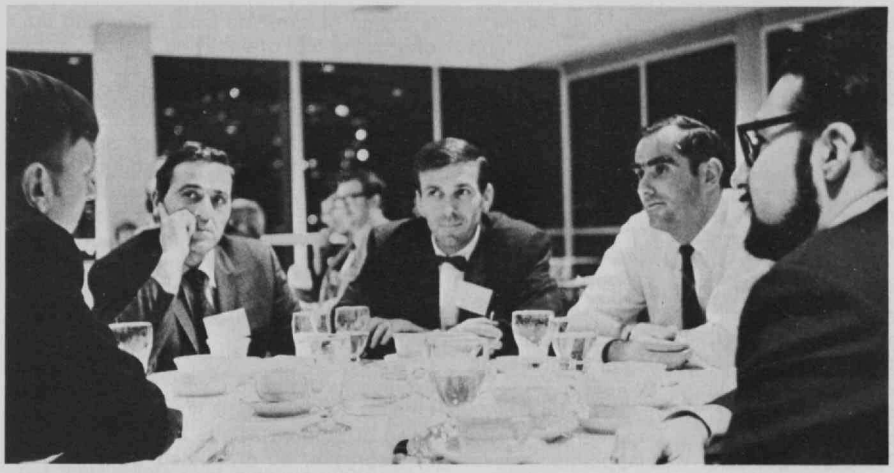
The Ford Professorships were endowed by the Ford Foundation at M.I.T. to advance interdisciplinary approaches to engineering, to introduce new methods of teaching, and to strengthen research in new engineering fields. Professor Gyftopoulos' appointment rests on his interdisciplinary work in electrical and nuclear engineering, to analyze the problems of operating nuclear reactors in electrical systems with varying loads; to study thermionic energy-conversion devices; and to advance the science of quantum thermodynamics.

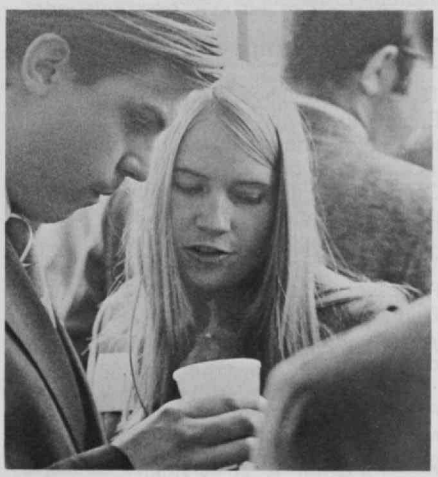
In 12 years at M.I.T. Professor Gyftopoulos has supervised the thesis research of nearly 50 graduate students; a native of Greece, he came to the Institute in 1953 following service in the Greek navy and engineering training at the National Technical University of Athens. He has served as U.S. delegate to the Third International Conference on the Peaceful Uses of Atomic Energy in 1964 and the Second International Conference on Thermionic Electrical Power Generation in 1968.

Today's Students and Tomorrow's Scientists: A New Image

Five years ago, M.I.T. became aware that the intellectual risk taker—that student to whom the context of a learning experience is more important than earning good grades and developing a high but narrow level of competence—was not staying beyond the first year of studies at the Institute. Benson Snyder, Dean for Institute Relations (*see* Technology Review *for January, pp. 30-37)* shared this and other insights into M.I.T.'s educational programs with secondary school mathematics and science teachers who gathered on

More than 80 high school teachers came to M.I.T. in November to discuss educational concepts and to meet with students—especially students from their home school districts, in some cases their former pupils—staff and faculty members under both formal and informal circumstances. The exchange of ideas was both brisk and thoughtful.





campus for a three-day conference, November 8 to 10, 1970.

The teachers, from about 80 public and private secondary schools around the country, learned what M.I.T. is doing to meet the challenge of today's students. The extraordinary rate of change in what is important means that today's educators must be extremely careful of the student who becomes adept without understanding the nature of what he is studying, Dean Snyder told them. Educators, they were told, must shift the reward system from the gamesmanship of getting A's to a more flexible system of developing informed intellectual risk takers.

The secondary school visitors gained at least a passing acquaintanceship with M.I.T.'s pass/fail system, tutorial programs, experimental study groups, and the work and ideas of the M.I.T. Commission on Education. Particularly stressed were the new efforts to bring science and technology to bear upon urban and social problems. Much of the formal program was devoted to understanding the interrelationship of science and technology to the humanities and the social sciences—stressing benefits as well as the dangers—and showing how careers which build upon these interrelationships can prove both challenging and rewarding to their students.

President Howard Johnson addressed the teachers at a concluding luncheon at the Stratton Student Center. Pointing out that our technology is responsible for population, economic, housing, and transportation problems, and that the effects of present technology are irreversible, President Johnson declared that solutions could only be found in a new and broader technology. "The challenges of tomorrow are so huge that the men to face them must be generalists; they must be able to determine what our purposes are to be, not just how to accomplish them," the President said.

How would you describe your work to the local Rotary Club? Perhaps not this way, but you need the same kind of imagination that makes it possible for Robert C. Reid, Sc.D.'54, to take the part of an eccentric scientist he chooses to call Mr. Toddler (above). Professor Reid's act of theater was part of a graduate seminar last fall on how engineers can better communicate.

Nuclear Engineering Head

Edward A. Mason, Sc.D.'50, Professor of Nuclear Engineering, has been named (effective July 1) to succeed Manson Benedict, Ph.D.'35, who has been Head of the Department since its founding in 1958 and who now has asked to be relieved of administrative duties in order to devote full energies to teaching and research as Institute Professor and Professor of Nuclear Engineering.

In announcing the plans for Professor Benedict to give up the leadership of the Department, Raymond L. Bisplinghoff, then Dean of the School of Engineering, called him "one of the world's leading authorities in the broad field of nuclear engineering. During his tenure," said Dean Bisplinghoff, "the Department of Nuclear Engineering has become one of the foremost in the nation."

The new Head of the Nuclear Engineering Department first came to M.I.T. in 1947 as a graduate student following undergraduate work at the University of Rochester (B.S. 1945) and service in the U.S. Navy. He received the S.M. degree in chemical engineering practice in 1948 and continued for the Sc.D. degree in chemical engineering. As Assistant Professor of Chemical Engineering for two years beginning in 1950 Professor Mason was Director of the Bangor Station of the School of Chemical Engineering Practice.

Professor Mason returned to M.I.T. to join the nuclear engineering faculty in 1957 after serving as Director of Research at Ionics, Inc.; his teaching and research interests lie in the areas of nuclear fuel and power management, nuclear power reactor engineering, nuclear space power and propulsion, and the effects of radiation on materials and separations processes.

For ten years Professor Mason directed a comprehensive study at M.I.T., sponsored by the U.S. Atomic Energy Commission, on the effects of nuclear radiation on the organic fluids used as coolants in nuclear reactors. In 1965, while on sabbatical leave, he carried out radiation effects research at the Euratom Research Center in Italy as a Senior Postdoctoral Fellow of the National Science Foundation, and in 1967 he was leader of an interdisciplinary technical and economic study of nuclear-industrial and agro-industrial complexes at Oak Ridge National Laboratory (*see "Nuclear Reactors: Transforming Economics as well as Energy,"* Technology Review *for March, 1969, pp. 25-26 ff.).*

Professor Benedict studied chemical engineering (S.M. 1932, Sc.D. 1935) at M.I.T. and returned to the Institute in 1951. One year later nuclear engineering was established under Professor Benedict's direction as a division of the Department of Chemical Engineering. Professor Benedict was appointed Institute Professor in 1969.

Theos J. Thompson, 1918-1970

Theos J. Thompson, Professor of Nuclear Engineering who was on leave of absence from the Institute while serving as a member of the U.S. Atomic Energy Commission, died on November 25 when the small plane in which he was a passenger crashed into Lake Meade, Nev. Two other passengers, Jack Rosen, Professor Thompson's A.E.C. aide, and William Smith of the A.E.C.'s Nevada test site, also perished in the crash; the pilot survived.

Professor Thompson was one of the nation's leading engineers in the design of nuclear reactors, and his two-volume work on *Technology of Nuclear Reactor Safety* is widely regarded as the definitive work in this field. In his announcement to the M.I.T. community, President Howard W. Johnson said Professor Thompson was "an inspiring teacher, an able administrator, and an expert on nuclear reactor design and operation. He was particularly recognized as an international authority on the safety aspects of nuclear reactors."

In January, 1970, he had told a conference session of the American Nuclear Society that excessive concern by environmentalists over radiation hazards had been carried to "an almost ridiculous extreme. It is as though we decided not to get out of bed anymore because we might slip on the way to the bathroom. It is a sign of age," he said, "of giving up, of growing old, of decaying."

On the day before his death Professor Thompson had told the Western States Conference of the Council of State Governments that the U.S. sought only to maintain its deterrent nuclear weapons force; the A.E.C.'s continuing testing program in Nevada was in support of this goal, he said. But he warned that the Russians were accelerating their military weapons programs "to a great degree."

Professor Thompson was born in Lincoln, Nebr., where his father was Dean of Student Affairs at the University of Nebraska; he graduated from the University of Nebraska in chemistry (B.A. 1941, M.A. 1942) and following World War II service at Edgewood Arsenal, Fort Benning, and the U.S. Military Academy, completed work for the Ph.D. in physics (1952) at the University of California (Berkeley).

Professor Thompson came to M.I.T. as Associate Professor of Nuclear Engineering in 1955 following three years at the Los Alamos Scientific Laboratory; he was in charge of the design and construction of the M.I.T. Reactor and continued as its Director until joining the A.E.C. in May, 1969.

Professor Thompson held the Ernest Orlando Lawrence Memorial Award of the A.E.C. (1964), for which he was cited "for leadership in developing safe, useful, and economic nuclear reactors, and for teaching of nuclear engineers;" and he was formerly a member and Chairman of the A.E.C.'s Advisory Committee on Reactor Safeguards. He was a Fellow and Director of the American Nuclear Society.

In a Manner of Speaking

Making yourself understood clearly—especially if your subject is technical—requires great skill, with which few engineers are naturally endowed. Realizing this, Robert C. Reid, Sc.D.'54, Professor of Chemical Engineering, decided to tackle the problem with a seminar of 10 graduate students during the first term last fall.

E. A. Mason, Sc.D.'50

A. C. Price, '50

J. C. Willing, '69

J. Wei, Sc.D.'55

The seminar met formally for two hours each week, with student presentations videotaped. Then the class went to dinner, where a master of ceremonies was chosen and several students—and, from time to time, Professor Reid himself—were picked to give brief, spontaneous speeches. After dinner the class reconvened to view the videotape and criticize the earlier session. Anything and everything, from the content of the presentation to the appearance of the speaker, were open to criticism.

Strictly a coat-and-tie affair at the beginning, the seminar gradually became more informal—and imaginative. Hesitant and nervous at first, students found their confidence growing as their ability to put their points over steadily improved. By the end, a few were even trying disguises as a way to make their communications come to life.—*Tech Talk*

Individuals Noteworthy

W. H. Dennen, '42, to Acting Dean of the Graduate School, University of Kentucky . . . **David V. Ragone,** '51, to Dean of the Thayer School of Engineering, Dartmouth College . . . **Thomas F. Malone,** Sc.D. '46, to Dean of the Graduate School, University of Connecticut . . . **Jerome W. Lindsey, Jr.,** M.C.P.'60, to Associate Dean of the Faculty of Design, Harvard University . . . **Paul O. Roberts, Jr.,** S.M. '57, to Associate Professor, Harvard Business School . . . **Richard E. Elder,** to Associate Professor of Chemistry, University of Cincinnati.

To **Paul A. Samuelson,** M.I.T. Professor of Economics, the Alfred Nobel Memorial Prize for Economics . . . To **James R. Slagle,** Ph.D.'61, selection as one of America's ten outstanding young men for 1969 by the U.S. Jaycees . . . To **William A. Jeffers,** Ph.D.'62, Assistant Professor of Physics, the Student Council Superior Teaching Award of Lafayette College . . . To **I. M. Pei,** '40, the Golden Door Award of the International Institute of Boston . . . To **J. C. Willing,** '69, the Marshall Scholarship awarded by the British Government for study in Britain . . . To **Paul W. Chin, Jr.,** '69, a fellowship from the American Can Co., awarded at the 7th Annual Fellowship Competition of the Printing and Publishing Industry . . . **Michael A. M. Keehner,** '65, **Douglas W. McIver,** '57, and **Gary P. Stern,** S.M.'66, elected George F. Baker Scholars by Harvard Business School . . . To **Philip L. Alger** '15, the 1970 Alumni Award of Merit of St. John's College, Annapolis, Md. . . . To **Jarold G. Abbott,** Ph.D.'60, a Citation for Achievement for alumni of William Jewell College, Liberty, Mo.

Paul A. Archibald, '34, to Fellow of the American Society for Mechanical Engineers . . . **Morris A. Steinberg,** '42, to Fellow of the American Society for Metals . . . **Gerhard L. Hollander,** E.E.'53, to Fellow of the Institute of Electrical and Electronics Engineers . . . **R. Clive Greenough,** '53, to Fellow of the American Institute of Chemists.

John W. Starke, S.M.'68, to Manager of Administration, American Society for Engineering Education . . . **Holt Ashley,** Sc.D.'48, to Vice-President—Technical, American Institute of Astronautics and Aeronautics; **Albert C. Hall,** Sc.D.'37, to Director-at-Large, A.I.A.A. . . . **Andrew C. Price,** '50, to President, National Council of Physical Distribution Management . . . **Cecily Cannan Selby,** Ph.D.'50, Head Mistress of the Lenox School, New York City, to President of the Head Mistress Association of the East . . . **W. Gerald Austen,** '51, to President-Elect, Massachusetts Heart Association . . . **Robert W. Mann,** '50, to President of the Catholic Guild for All the Blind in Newton, Mass.

Awards from the American Institute of Chemical Engineers to **Arthur B. Metzner,** Sc.D.'51, the William H. Walker Award; and to **James Wei,** Sc.D.'55, the Professional Progress Award in Chemical Engineering . . . To **Fred J. Vogel,** '15, the William M. Habirshaw Award of the Institute of Electrical and Electronics Engineers . . . To **C. Stark Draper,** '26, the Elmer A. Sperry Award of the American Society of Mechanical Engineers.

To **Richard H. Pough,** '26, an honorary Doctor of Laws degree from Haverford College . . . To **Crawford H. Greenewalt,** '22, and to **Athelstan Spilhaus,** S.M.'33, honorary Doctor of Science degrees from Hamilton College . . . To **Luis A. Ferre,** '24, and to **Thomas D. Cabot,** honorary doctorates from Harvard University . . . To **C. Lalor Burdick,** '13, honorary Doctor of Laws degree from Drake University.

Darrell Marks, S.M.'59, to direct a summer workshop for secondary school teachers, funded by the National Science Foundation . . . **J. W. Lathrop,** '48, Professor of Electrical Engineering at Clemson University, to direct an international lecture series in Europe on large-scale integration in microelectronics . . . **Douglas L. Brooks,** Sc.D.'43, to the Marine Affairs Action Group . . . **James R. Killian, Jr.,** '26, on the Sloan Foundation's Commission on Cable Television to study the impact and prospects for the medium . . . Among the 17 White House Fellows selected for 1970-71: **Ronald O. Baukol,** S.M.'60; **Melvyn R. Copen,** '58; **John Nils Hanson,** '64; and **Dana G. Mead,** Ph.D.'67.

M.I.T. in Latin America

Can Institute alumni in Latin America, organized through the M.I.T. clubs in major cities throughout the continent, join to become a catalyst for the development of science and engineering in those nations?

Suggestions for such a program were the subject of Oliverio Phillips Michelsen, '48, who has served as an adviser on science developments to the United Nations and to various Latin American governments, at a meeting of the M.I.T. Club of Mexico City this fall.

Dr. Phillips proposed that M.I.T. clubs could be the vehicles for exchange of information and perhaps for action on policy matters affecting science and engineering. For example, it might be possible for M.I.T. clubs to make specific proposals on new laws regarding patents, royalties, exchange of technical services, and tax incentives to encourage the growth of science and technology in their countries. Dr. Phillips expressed his strong belief that Latin America talent in science and technology must be encouraged to stay at home through a combination of government and private-sector assistance to students, teachers and researchers—such as through scholarships and through providing an environment within which the products of research will be applied.

Alumni Calendar

Boston—February 11, Thursday, 12:15 p.m.—Luncheon meeting, Aquarium Restaurant. Speaker: Dr. Albert G. Hill, Vice President of Research. Topic: Institute-Government Relations.

Cambridge—June 6, Sunday—The Club Presidents' Conference is rescheduled to this date to coincide with Alumni Homecoming activities.

Chicago—February 1, Monday—Dinner meeting. Speakers: Kenneth M. Hoffman, Professor and Chairman of the Commission on M.I.T. Education, and Samuel W. Bodman, '65, Professor of Chemical Engineering. Topic: Creative Renewal in a Time of Crisis: Report of the Commission on M.I.T. Education.

Fairfield County—February 26, Friday, 6:30 p.m.—Dinner meeting, Holiday Inn, Darien, Conn. Howard W. Johnson, President of M.I.T. will be honored at the 57th Anniversary Dinner of the M.I.T. Club of Fairfield County, joined by the M.I.T. Club of Westchester County. President Johnson's address followed by a question and answer period.

New York—February 9, Tuesday—Luncheon meeting. Speaker: Kenneth M. Hoffman, Professor and Chairman of Commission on M.I.T. Elucation. Topic: Creative Renewal in a Time of Crisis: Report of the Commission on M.I.T. Education.

Northern New Jersey—February 18, Friday, 6:30 p.m.—Dinner meeting. Speaker: Dr. John Horton, '49, Chairman of the New Jersey Clean Air Council on Air Pollution.

San Francisco—February 2, Tuesday—Meeting, 4:30; wine tasting, 6:30; dinner, 7:30 p.m. Speakers: Kenneth M. Hoffman, Professor and Chairman of the Commission on M.I.T. Education, and Samuel W. Bodman, '65, Professor of Chemical Engineering. Topic: Creative Renewal in a Time of Crisis: Report of the Commission on M.I.T. Education.

Washington, D. C.—February 27, Saturday, 10:00 a.m. to 4:30 p.m.—Regional Conference, at the National Bureau of Standards, Gaithersburg, Md. Speakers: Howard W. Johnson, President of M.I.T.; Robert W. Mann, '50, Professor of Mechanical Engineering. Topic: Engineering Aids the Handicapped; Philip Morrison, Professor of Astro-Physics. Topic: The New Cosmos; William H. Matthews, '65, Professor of Civil Engineering. Topic: Man's Impact on the Global Environment; Walter A. Rosenblith, Associate Provost. Topic: Toward a New Educational Process.

M.I.T. Club News

The eight-year-old M.I.T. Club of South West Florida met for a buffet luncheon on December 28. Their guests—those students living in the area who are now attending M.I.T. and several Sarasota High School Seniors who have been accepted into the Class of '75—received a special invitation to this luncheon in their honor from Dana Ferguson, '52, newiy-appointed local Educational Counsellor. President Ray Holden, '23, presided as Ty Rabe, '72, gave the score of alumni attending a "roadside" seat at the 1970 Clean Air Car Race.

Lowell L. Holmes, '23, Secretary and Treasurer of the club, has produced a roster of M.I.T. alumni residing in South West Florida which the club plans to distribute to members.

The Indiana Association of M.I.T. sends word of some interesting observations gleaned from the presentation to them by Nancy Bellman, a Public Relations expert from the Public Service Company of Indiana. A Russian and Chinese scholar, her extensive studies and travels through the Soviet Union yielded the following statements: the country encompasses 70-odd different peoples and is more truly a "melting pot" than the U.S.A.; dress of the style and quality comparable to that worn by her Indiana audience would have cost a Russian woman $90 in 1968 but only $30 in 1970; and where several families of 10 or 12 would have occupied a 1200-square-foot apartment in 1968, a single family will now occupy 800 to a thousand square feet of housing.

Deceased

Walter R. Kattelle, '00, September 22, 1970
W. Cornell Appleton, '01, November 15, 1970
Leyland C. Whipple, '04, November 12, 1970
Edward T. Steel, '05, August 29, 1970*
Otto B. Blackwell, '06, November 26, 1970
Norman P. Gerhard, '06, February 25, 1970*
George R. Guernsey, '06, November 25, 1970*
E. Kent Lawrence, '06, April 28, 1970
Charles G. Loring, '06, September 3, 1966
Lawrence B. Webster, '06, October 7, 1969
Joseph M. Baker, '07, October 2, 1967
J. Ellis Doucette, '07, August 19, 1970
Ralph G. Kann, '07, May 18, 1969
Floyd A. Naramore, '07, October 31, 1970
Frank W. Willey, '08, August 22, 1970
Kenneth S. May, '09, December 24, 1970
Julius H. Serra, '09, August 1969
George S. Emerson, '10, November 9, 1970
Laurence T. Hemmenway, '10, December 9, 1970
Carl J. Sittinger, '10, November 24, 1970
William C. Lynch, '12, August 21, 1970
Lee Bowman, '13, August 23, 1970
Alfred W. Devine, '14, December 1, 1970*
Ernest M. Loveland, '15, December 2, 1970
Albert Sampson, '15, December 16, 1970
Robert W. Diemer, '16, October 9, 1970
Kenneth E. Bell, '17, December 16, 1970*
Joseph J. Clarkson, '17, September 10, 1970
Edward Y. Keesler, '17, November 27, 1970
Frederick W. Barney, '19, November 24, 1970
Prentice D. Ash, '20, November 6, 1970
Charles C. Moore, Jr., '20, November 10, 1970
Ralph G. Barrows, '21, November 16, 1970
Robert A. Eckles, '21, January 31, 1968
Leland H. Hewitt, '21, March 31, 1964
Philip Meyer, '21, September, 10, 1967
Alfred B. Quinton, Jr., '21, September 25, 1968
William C. Ready, '21, December 19, 1970*
Arthur L. Silver, '21, July 26, 1970
Edward G. Sparrow, '21, November 15, 1967
John O. Beasley, '22, April 25, 1969
Philip Caplain, '22, August 4, 1970
Mrs. Elizabeth H. Hawks, '22, June 28, 1969
Peter T. Lamont, '22, November 25, 1970
Notley Y. Du Hamel, '23, October 23, 1970
Louis F. Porter, '24, November 28, 1968
A. Whitney Rhodes, '24, February 1969
David T. Bulkley, '25, July 16, 1970
Henry D. Hirsch, '25, December 7, 1970
Mrs. Ellen P. Rieg, '25, May 13, 1967
William B. Glynn, '26, September 17, 1970
Harland F. Lancaster, '30, April 16, 1970
Henry R. Westphalinger, '31, May 19, 1970
Ralph M. Carpenter, '32, September 22, 1970
Lawrence M. Hubbard, '32, December 30, 1969
Kenneth Hobart, '32, March 24, 1970
John M. Cooper, '34, October 31, 1968
Gordon Day, '35, April 24, 1970
Constantin A. Pertzoff, '35, June 26, 1970
Edgar J. Staff, '35, February 14, 1970
Perry S. Lobdell, '36, December 5, 1970
Robert E. Worden, '36, December 5, 1970
Irving Cohen, '39, September 25, 1970
James R. Cruciger, '39, September 16, 1967
Judson W. Wark, '39, October 6, 1970
Robert A. Bittenbender, '40, December 13, 1970*
Chase Godfrey, '40, May 18, 1967
Paul A. Reynolds, '40, September 13, 1968
John W. Ludwig, '41, November 21, 1970
Robert A. North, '42, March 20, 1970
Mihai P. Pancu, '42, March 12, 1970
Jay L. Upham, Jr., '43, March 1970
James H. Grimes, Jr., '44, June 15, 1970
Clarence W. Nordin, '46, November 1966
J. De Witt Wyant, '47, January 1, 1970
John P. Dyer, '48, April 7, 1970
Carroll E. Adams, Jr., '49, May 12, 1970
Andrew C. Batten, '50, March 13, 1968
Griffith May, '51, November 5, 1970
William H. Feathers, '52, November 9, 1970
Hudson L. Whitenight, '60, November 26, 1970
Robert F. Duff, Jr., '63, November 25, 1970
Arthur J. Greenberg, '64, July 14, 1970*
Craig B. Schille, '66, October 24, 1970

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Class Review

95

A telephone call to the Nursing Home informed us that **Luther Conant** is holding his own. Luther is one year older than I which makes him 98! We must be tough old birds!

It was a real surprise and pleasure to receive the citation for contributions to the *Tech Review*. Thank you!—**Andrew D. Fuller,** Secretary, 1284 Beacon St., Brookline, Mass. 02146

96

One delightful Indian summer afternoon I found myself in Berryville, Va., and called on Mr. **William E. Barbour** and his daughter, Jane. Your classmate was in excellent health and spirits and we had an enjoyable chat about M.I.T.—then and now. He had visited a son in Lexington last summer and while there they had gone to see the new buildings in Cambridge and had also re-visited Charles Street where he had had his quarters during the two years he was at "Boston Tech."

He recalled vividly the large lecture hall in the Rogers Building and some of the activities carried on within its walls. I realized that this was where the Lowell Lectures were held when I was in school. It was there that I first saw and heard a real scientist when I attended lectures by Millikan.

The Gay Nineties were also recalled as Mr. Barbour told me about his attendance at a very formal ball given by Mrs. Jack Gardner at her "Palace." This is a museum to me, but to him it is still a private home where, with a few other fortunate young men, he was invited to augment the ranks of partners for the quadrille!

After Thanksgiving, the Barbours left for their annual trip to the South. They were to visit another of his daughters in Georgia, where she teaches. A third daughter teaches in a mission school in the Orient.—**Clare Driscoll,** Acting Secretary, 800 4th St. SW, Washington, D.C. 20024

98

As I promised here are the names and addresses of the living members of the Class of 1898: **Alvan L. Davis,** 25 Concord St., Waterbury, Conn. 06710; **Lyman F. Hewins,** Route 2, Box 26, Leonardtown, Md. 02650; **Robert Lacy,** 201 Tunbridge Rd., Baltimore, Md. 21212; **George K. Newbury,** 525 Fourth Ave. W., Hendersonville, N.C. 28739; **Walter Page,** 410 Arthur's Round Table, Wynnewood, Pa. 19096; Professor **Joseph C. Riley,** 518 Great Plain Ave., Needham, Mass. 02192.—Mrs. **Audrey Jones Jones,** Acting Secretary, 232 Fountain St., Springfield, Mass. 01108

01

We report with great regret the death of **Bill Holford,** who had assumed the duties of Class Secretary in succession to the late Ted Taft, who had held the office since graduation. It is hoped that Bill's successor as Class Secretary will be reported in our next issue.

William Gordon Holford was born September 6, 1878, in New Haven, Conn. After preparation at Wilbraham Academy, he graduated from M.I.T. in architecture. Joining with his classmate, the late Ellis F. Lawrance, he practiced his profession in Portland, Ore.; the junior member of his firm of Lawrance, Holford, Allyn and Bean still survives. Bill interspersed his professional work with skilled carpentry and oil painting.

After his marriage to Florence Fowler of Brooklyn, N.Y., he greatly enjoyed reunions with his enlarging family and in his later years spent much of his time with his married son, Dr. W. G. Holford, Jr., at Klamath Falls, Ore., and his younger daughter, Mrs. Robert Patterson at Lake Oswego, Ore. His daughter, Mrs. Robert J. Lucas of Salem, Ore., has reported that his final days were spent at a family reunion in celebration of his 92nd birthday. Returning from it he experienced a car breakdown just avoiding a near fatal accident, which put him in the hospital. Though his personal injury was slight, the nervous shock induced a coronary occlusion resulting in his death on September 15.

With warm sympathy, we extend to his family our congratulations on his long, valuable and happy life.—**Edward H. Davis.**

05

It was refreshing to hear last month from Helen and **Dean Klahr.** I had felt that no news was good news but now we have the explanation for the "no news." Dean writes, "To bring you up to date with news of Helen and me I will go back a year and ten months to January 1969 when I had my first operation. It must have been a honey because Helen said I was delirious for a week. Later in the year I had two operations for hernia and to put the icing on the cake Helen had a stroke in November 1969. Fortunately it was a very light stroke and to talk with her now you would not know anything was wrong. As for myself, I have recently been reappointed to the Board of Viewers for a three-year term and due to much activity in interstate highway construction in this county, I am quite busy. I now have eight cases pending."

How's that for courage and optimism? A guy ninety years old accepts a three-year appointment to a job which he, of course, accepted in retirement and loves. He has explained to me previously that a viewer evaluates the award made by the state on a possessed property and decides whether it is equitable. I am sure every 1905 man hopes "C.D." will complete his term and apply again for reappointment.

I regret having to report the death of **Edward T. Steel** (Ted), who died on August 29, 1970 at the home of his daughter, Helen S. Lillibridge, 4535 Howard Ave., Western Springs, Ill. She writes, "My father was not so strong during the past year as he had been, and arteriosclerosis was taking its toll. But his wonderful sense of humor was with him to lighten his frailties. He never complained of his handicap of lack of sight except that his inability at the table might inconvenience us. My husband and I listened with him gladly as he played his 'talking books.' He enjoyed biographies, world events, maintaining a keen interest in the developing world. His four grandchildren were always a great joy."

We had heard little from Ted during the last many years (except for letters from his daughter), but as I remember him during his years I can understand his sweetness of spirit during the years of diminishing sight.

Changes of Address: Robert S. Beard, P.O. Box W, Trinidad, Calif. 95570; Edward J. Poor, 2404 No. Atlantic Blvd., Ft. Lauderdale, Fla. 33305.—**Fred W. Goldthwait,** Secretary-Treasurer, Box 32 Center Sandwich, N.H.; **William G. Ball,** Assistant Secretary, 6311 Fordham Place (note change), Bayshore Gardens, Bradenton, Fla. 33505

06

Here it is the middle of December as I write and you will be reading this message around the middle of February. So it seems silly to say that the Christmas Cards have been coming in but they have been, and Marion and I are grateful and thank you for thinking of us.

Through the Alumni Office we hear that **Ed Bartlett** up in Milwaukee is in good health—he believes that the steam baths he takes are keeping him spry, perhaps his good wife helps too. . . . **Walter Davol** sent a color card of Portland, Oregon, with 11,000 foot Mt. Hood in the distance. Walter was visiting his son in November.

Bob Cushman, who has lived in that same Portland for many years, told us he soon expected to be a greatgrandfather for the third time and "with each new arrival I seem to be feeling younger and am really enjoying life; drive my car around the city (population a million or so) but do not take any long trips."

As Acting Class Agent I receive reports from the Alumni Fund Office of '06 contributions and try to send a thank-you card to each donor. But if you don't get a card, let me take this opportunity to thank you so much for your gift.

There are three deaths to report; **Norman P. Gerhard, George P. Shingler** and **George R. Guernsey.** Norman Paul Gerhard, Course I S.B., was born June 2, 1884, in New York City and died February 25, 1970, in Richfield Springs, N.Y. after a long illness. While at Tech his home was Brooklyn where he attended the Boys High School. He was vice president of our Civil Engineering Society and a member of the Cross Country Association, The Technology Club, and Deutscher Verein. His thesis was "A Plan for the Improvement of the Gowanus Canal in Brooklyn" (with Brietzke). In 1908 Norman married Mary Brink who died in 1945. They had a son and a daughter; early in December the Alumni Office received an interesting letter from the son—Paul M., M.I.T. '33 covering his father's career in detail. From 1906 to 1918 Norman was Assistant Engineer, Board of Water Supply, N.Y. City, and for a year or so was resident engineer with J. H. Fuertes in charge of reservoir, aqueduct, filtration plant, and sewers, for Cumberland, Md. From 1919 till 1952 he was president of Norman P. Gerhard Inc., Scarsdale, N.Y. engaged in road construction, sewers, water supply, gas and electric lines, topographic and property maps, school and playground layouts. He was an expert witness in many court cases. In W.W. I, Norman was designing engineer with a New York City architectural firm on airfields, etc. From 1952 till 1963 he was consulting engineer for the town of Somers, N.Y. Paul says his father was a Rotarian; a Mason, and a member of Scarsdale Congregational Church; active in the University Glee Club and the White Plains Choral Society. He had been awarded the distinction of Fellow, American Society Civil Engineers. What a helpful, useful, rewarding life!

George Pinckney Shingler, Jr., Course V, was born November 28, 1879, in Walterboro, S.C. and died August 19, 1970, presumably in Florida where he had been living for 30 years or so. While at Tech his home address was Donaldsonville, Georgia. He had obtained a B.S. degree at Mercer University, Macon, Ga., and for his M.I.T. degree his thesis was "Standards—for Pure Malt Vinegar." For 10 years he was a professor of chemistry at Emory College, Oxford, Ga., and for some 40 years was in U.S. government service, the Bureau of Chemistry, in Savannah, eventually becoming senior chemist-in-charge, U.S. Naval Stores Station, Bureau of Agriculture, Olustee, Fla. In the early Sixties he was a field agent for the Masonic Service Association, retiring in 1967 to 624 S. Hernando St., Lake City, Fla. In 1967-68 George and I had a brief exchange of letters in which he told of having a son and two daughters and seven grandchildren. In May 1967 in a note with his gift to the Alumni Fund George said, "I am now retired but can walk a couple of miles a day." That was when he was 88! He was spry too.

George Rockwell Guernsey, Course I, S.B., was born February 15, 1884, in Canton, Pa., and died of bronchial pneumonia on November 25, 1970, in the hospital in Sarasota, Fla., his home town for several years. He had prepared for Tech at Winchester High, was a member of our Soph relay team and the Civil Engineering Society. His thesis was "Efficiency Test on the Rife Hydraulic Engine," with Carroll Farwell. For the first few years George was in engineering work becoming Junior Engineer, U.S. Reclamation Service, Rupert, Idaho, but by 1915 he began a long and successful career in banking and investments. For a while he was with N. W. Harris & Co. in Boston, and a few years later became treasurer of Dana Hall Schools in Wellesley, a position he held until he retired in 1967 to live with a married daughter, Mrs. C. Carl Lockhart in Wilmington, Del., for a spell before beginning apartment living in Sarasota. In 1916 George married Elsie Marion Seabury of Wellesley who died December 27, 1963. They had three daughters: Mary (Mrs. Lockhart whose husband was M.I.T. 1928), Elizabeth (Mrs. Albert I. Heckbert, San Jose, Calif.), and Helen (Mrs. Norman P. Bates, Seattle, Wash.). Through the years the Guernseys were dear friends of Marion and myself.—**Edward B. Rowe,** Secretary-Treasurer, 11 Cushing Road, Wellesley Hills, Mass. 02181

08

We are sorry to report the deaths of **Chesney H. Criswell** of Estes Park, Colo., a chemical engineer, and **Herbert C. Elton** (85) on September 16, 1970. He appeared to be in good health when he reported in the March 1970 *Review* that he was continuing the practice of architecture and engineering.

We have a report from **Arthur B. Appleton** of Beverly, Mass. He was with our Class for three years. From 1912 to 1948 he was with the Massachusetts Highway Commission, as office engineer for the Department of Public Works. He received a Professional Engineers certificate from the State in 1947. During his last 24 years of retirement, Arthur was a member of the Beverly Planning Board for 15 years and president of the Beverly Historical Society, also a corporator of the Beverly Savings Bank.

For new addresses we have: **Ferdinand J. Friedman,** 1247 Gay St., Montreal, P.Q., Canada, and **Edgar I. Williams,** R.D. #1, Indian Trail, New Milford, Conn.—**Joseph W. Wattles,** Acting Secretary, 500 Park Blvd., Apt. G-4, Venice, Fla. 33595

10

It is with regret that I have to report the deaths of **Larry Hemmenway** on December 9, 1970 and **Carl Sittinger** on October 24, 1970.

Larry did not attend our 60th reunion and he was greatly missed. Carl attended the reunion and according to a letter received from his wife, Irene, he was especially proud to be at his 60th.

I had a brief note from **Allen Gould** saying he expected to be in Boston sometime this winter. I hope he follows his usual practice of calling on me in my new office.

Walt Spalding writes that Mrs. Spalding greatly enjoyed the 60th class reunion.—**Herbert S. Cleverdon,** Secretary, 112 Shawmut Ave., Boston, Mass. 02118

11

About 50 classmates received a letter in October regarding our 60th reunion and failed to send back the enclosed reply card. Let's hope they are still trying to figure out how they can make it. You recently received a second letter and another card. Look over the list of those who either expect or hope to come, really give some thought to the matter and send back the card. For those who

sent back the card saying they would not attend, another card was sent along so they could change their minds and come. President Howard Williams wants 30 classmates to be on hand.

Harry Tisdale, who went to Fort Meyers Beach, Fla., to live when he retired, made his first trip north (since the time of our 50th reunion) last year to visit his sister in Salem, Conn. He says he needs a guide to find his way around Groton and New London where he spent his youth. He cuts the lawns for half a dozen of his neighbors to keep busy and this winter took a course in defensive driving given by the State Highway Patrol. . . . President **Howard Williams** says he and Katherine are well and very busy. He took a trip north in November. . . . **Allston Cushing** and his wife, who live in Kansas City, spent Thanksgiving with their son and his family in Los Angeles. They had a week's visit and greatly enjoyed their two grandchildren, 11 and 13 years of age. Aside from his family Allston's greatest interest is in the American War Dads of which he is the national secretary. . . . **Frank Smith** sent me some ideas with which I agree: "Anyone who worked for an M.S. or Ph.D. would best work four years as an apprentice at his chosen life-work where he would meet men and work with them and deal with them, i.e., learn the facts of business life and then study about related subjects and theories." Frank's health is not the best and he finds that shuffle board with neighbors in the Arcadia in Honolulu where he lives is about the heaviest exercise he can stand. . . . Marj and **Fitz Fitzherbert** are spending the winter in Mallorca as usual. Something over a year ago their son and son-in-law passed away.

I have two changes of address: Mrs. **Ruth D. Tolman,** Box 16, Chocorua, N.H. 03817; and **Frederick L. Woodlock,** 30 Lincoln Lane, Ridgefield, Conn. 06877.

During the past fall I attended five meetings at M.I.T.: Class Secretaries, Five-year Reunion Chairmen, Alumni Officers' Conference, and two gatherings of the Alumni Advisory Council.—**Oberlin S. Clark,** 50 Leonard Rd., North Weymouth, Mass. 02191

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DO YOU REMEMBER the coffee pot we used to keep boiling at night well into the wee small hours at exam time in order to pep us up when studying. I drank so much that I developed an immunity, and could still pass out with four or five cups under my belt. In fact, coffee still fails to keep me awake.

Charles (Mac) **McCormack,** Course I, and our "senior citizen" at 84, writes from West Medford, Mass., calling our attention to the fact that his college affiliation was the University of New Brunswick, not the University of Maine. Since the passing of his wife, in August, 1969, Mac has been living alone, and doing his own cooking. He is in reasonably good health and last fall visited his grandson, who is superintendent of Sarasota National Park, to enjoy the autumn foliage and the beautiful Adirondacks country. He sees his neighbor, **John Pettingell,** frequently. His son is general manager of United Foods in Salisbury, Md. Of his 13 grandchildren, one is a senior at Vanderbilt and two girls are taking graduate courses at Stamford and Chapel Hill respectively. Best wishes from all of us, Mac! . . . **Harold Manning** and Helen are well, and enjoying apartment life in Woodbury, Conn. They spent their usual summer vacation at Isle of Springs, Maine, where Harry's two brothers also have cottages. Harry writes that he still plays golf and bowls regularly. He is also active at the University Club in Waterbury. . . . From Florida, **Jack Connolly** reports that he is well except for a persistent case of the shingles, and that he is reasonably active in the fuel oil business which is keeping him out of trouble. His son and one daughter live in Florida so he has an opportunity to visit them occasionally. Last summer the Connollys enjoyed a family reunion with twenty-one present, which is a real crowd. . . . **Nelson Breed** is still a practising architect in Wilton, Conn., but is working towards retirement. Last fall he and his wife took the trip abroad for which they had long planned. They visited Switzerland, Austria, Greece and the Islands, Turkey and Ireland. Nelson had not been abroad since 1919, during World War I. As an architect he particularly enjoyed the structural beauty of Greece. . . . We received a class contribution and a very brief note from another architect, **Parker Brown** of Revere, Mass., who took a special course with us. Parker is now fully retired and is enjoying good health. . . . **Bernard Stevens** took a special course with us for two years and then went into residence building construction in which he worked for about 12 years. He then became a manufacturer of casement windows until 1934 when he became active in property management, retiring in 1942 to Chatham, on Cape Cod. "At the present time I enjoy perfect health except for failing eyesight which prevents me from reading much."

When in Cambridge last October to attend the meeting of Class Secretaries, I visited the *Technique* office and was most pleased to be able to purchase a copy of the old 1912 issue of the year book—incidentally, the very last copy available. At that time I chatted with a group of the students about "the good old days," and was pleased and most interested in the comments which one of them, Dov Isaacs, sent with the book. It reads, "I know you will be interested in the viewpoint expressed by one of the present generation of college students, which I feel differs radically from what the local and national press would indicate. Most of my classmates are trying to obtain the same type of education that inspired you and your class to seek an M.I.T. education, or perhaps I should

Walter Slade, '12

say, experience. I cannot help feeling that each class helps pave the way for the next, and that your class had its part to play in my own education. For this and for your continuing interest in M.I.T., I thank you very much. I wish you many more years of health and happiness."

We are most pleased to hear from **Walter Slade,** Course V, who is a native of Providence, R.I., where he still lives. He earned his M.S. degree from Brown in Chemistry, in 1908, and then entered Tech where he obtained another M.S. degree in 1912. After four years in research work with General Electric, he became superintendent of power and later vice president of the former United Electric Railways Company and directed their expansion program. In 1929 he started a career with the New England Power Service Company where he continued as gas service engineer until his retirement in 1950, after which he served as a consultant for a few years. He has been a member and executive of the Providence Engineering Society, the American Institute of Electrical Engineers and other technical organizations and is an honorary life member of the New England Transit Club. At 85 he is in good health, as is his wife, Esther. They have a son, Winton, who graduated from M.I.T. in 1940 as a chemical engineer. . . . **Ned Osthaus** writes from Scranton, Pa., to say that he spent but a part-term at M.I.T. to take a special course in sugar chemistry. He was graduated from Allegheny College at Meadville, Pa., then worked for a number of years with Goodyear Tire and Rubber in Akron, Ohio. . . . We have a most interesting letter from **Freeman Pretzinger** who spent two years with us in Course IV, followed by another year in design. He is still active as the head of a firm of architects and engineers in Dayton, Ohio, following in his father's footsteps. In 1919, after a few years training in that office, Freeman assumed charge of the design and remodelling of buildings in the Quartermasters Corps at Camp Sherman. In 1920, he returned to Dayton and soon became a junior partner with Pretzinger and Pretzinger, a partnership that lasted until his father's death in

1940. From 1940 to 1961 he practiced by himself as Freeman A. Pretzinger, Architect. In 1961, his son, Albert II, became a partner and five years later, his second son, Robert, joined him as a partner and structural engineer. The firm has done outstanding work in Dayton and vicinity, specializing in public buildings, schools and libraries, but in little residential work. Freeman married in 1926 but lost his wife suddenly in 1934. He married again in 1935 and has another son by this marriage. His two older sons are carrying the business load beautifully, so he will have no hesitation in quitting work when he feels it is advisable. He writes that he gave up golf and fishing a few years ago, but still enjoys his business contacts. . . . **Walter Green** writes from Palm Beach, Fla., that he has sold his summer home in Vermont and spent a hot summer in Florida.

We remember **Bob Cox,** who spent a unique career as a successful owner of a dude ranch in Wyoming and who has since retired to Saratoga, Calif. He now lives near his son and five grandchildren and says it is an excellent place to retire. His home is on an isolated hilltop surrounded by orchards. He writes, "In reply to your touching appeal for news, we certainly do nothing worth mentioning. We did get East this summer, primarily to attend my wife's Wellesley reunion, but visited friends and relatives from Cape Cod to Richmond; then stopped in St. Louis and Denver on our way home. Otherwise, we bask in some of this country's finest climate. But we live too near to those optimists at Stanford to have a very cheerful outlook. However, we plan another trip East next fall and will stop in Wyoming when we return. We may visit Yosemite in the spring." Bob, you still are able to cover quite a bit of the country. Good luck! . . . **Bertrand Brann** writes that after obtaining his M.S. degree from the University of Maine in 1911, he came to M.I.T. and obtained a second degree as a graduate student in 1912. He spent four years as an instructor at Lowell Institute in Boston, after which he returned to the University of Maine where he taught chemistry until his retirement in 1955. He is now living in Winthrop, Maine, and is apparently in good health.

We are sorry to announce that **Jay Pratt** has resigned as Assistant Secretary. Neither he nor Priscilla are in good health, although they are slowly improving, and they do not plan to take their usual trip to Acapulco this winter. We shall greatly miss the assistance Jay has rendered in this secretarial work for the past three years. I know that all of us join in wishing them both improved health in the near future.—**Ray E. Wilson,** Secretary, 304 Park Ave., Swarthmore, Pa. 19081

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"Time marches on." It was quite a day for your secretary on his 80th birthday, December 2, 1970. We all have been through national elections and a Thanksgiving and still must appreciate that the United States is the best country in the world.

We received a letter from **Frank Achard** following a successful eye operation. We quote, "Many thanks from you and the Class of 1913 for the 'get well' and 'welcome home' cards. I left the hospital on the 5th and corralled my pups on the 6th, feeling chipper. I am, however, enjoined from such pleasurable pursuits as bowling, girl chasing, and heavy house cleaning. Monday morning a neighbor took me shopping and thanked me for asking her. I know how she felt because I have the same reaction when asked to do someone a 'good deed for the day.' I hope that we have a get-together next June, preferably on the Cape. The house looks like a carrot garden and I'm really looking forward to being able to push or pull a vacuum cleaner and shove the furniture around. Perhaps when the time comes I'll find other excuses. I'm awfully lazy these days. Cheers to both of you, Frank."

Our very active correspondent, **Allen Brewer** writes: "Enclosed is my check for annual dues per your statement. Sorry if I am a bit late. Since I last wrote to you by copy of my letter pertaining to the 'Mayflower' to Bill Brewster, nothing much has transpired down here. Our weather has been kindly, no hurricanes but quite some rains. A couple weekends ago Maurine and I attended the Florida Exposition of Stamp Clubs in Orlando. We had quite a field day collecting more commemorative stamps to add to our 'Waterfall' collection. In between times I'm continuing writing editorial articles for the Minkus Stamp Journal. It's a good diversion from the run-of-mine yard chores. Incidentally did I tell you that one of our grandsons, John Jr., now a music major student at North Texas State University, recently gained his Eagle Scout rank in the Boy Scouts of America in Frederick, Md. Krista, one of our granddaughters is at Denison University in Ohio, and there are two others of the clan at the University of Kentucky. Terry, who is married, and Susan, Allen Jr.'s children. This is about all the family news. Remember us to Roz and her Mother."

Again, we must mention the splendid effort **Bill Brewster** always has done as our 1913 Alumni Fund Agent. A short note was received from Bill, bringing to our attention the citation he received from the Alumni Association for his leadership. As usual, he stated that the credit for the Class of 1913 should be given to the contributing members of the class, rather than to Bill Brewster.

A beautiful letter has been received by the Capens from Marguerite Kelly, (Prescott's widow). After 55 years of marriage, she deserves a great amount of love and praise for those many years of constant helpfulness with Prescott. . . . We are looking forward to our 60th in 1973 and seeing our classmates again.—**George Philip Capen,** Secretary-Treasurer; **Rosalind R. Capen,** Assistant Secretary, 60 Everett St., Canton, Mass. 02021

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A Christmas card from Florence Richmond (Petersen) says: "Have recently married William Petersen in Centerville, Mass. Bill has been a long time friend of our family. We shall continue to live in Cambridge and spend part of our time at Centerville, Cape Cod." . . . We have a Christmas note also from Edith and **Hib Busby,** P. O. Box 68, La Grange, Texas 78945. "Dear Friends: We realize that many of our friends will not be aware of our change of address, so we are sending this letter in place of our usual Christmas card. Also, since Buz is facing the probability of a cataract operation shortly, we are sending our Christmas greeting early. For some time we had been looking toward our present location because it is nearer to Edith's sister's farm (five miles from here) and half the distance Dallas used to be from us, and the children are there or nearby. But hurricane 'Celia' hurried us a little! We expected to ride out whatever came but the last-minute twist turned the hurricane directly in on Corpus Christi and in a matter of an hour the apartment where we lived was rendered untenable. We managed to exist there (mostly on the porch in ninety plus temperature) for four days then were rescued by a truck Edith's sister sent from Houston and moved us up to the farm. While at the farm we were most fortunate to obtain the only rental house in La Grange and moved in late in August. Now we are settled and have a pleasant house, yard and surroundings. But that period without electricity, ice or any other normal service will remain in memory a long time. La Grange is a prosperous town of about four thousand, occupied almost equally by German and Bohemian (Czechoslovakians who are very industrious, friendly and helpful). It is a good town to live in and the surrounding country is beautiful —far more interesting than the coastal bend country. So, a Merry Christmas to you and a very Happy New Year. We look forward to this as a very good place to live and expect to remain here. Edith & Buzz."

Robert Townend sends word that **Bill Simpson** passed away last September 25 after a long complication of illnesses including surgery. He was best man at Bill's wedding. Bill's first wife died some years ago; his second wife survives him. His last address was Arbor Manor, Apt. A, 325 Arbor Drive, San Diego, Cal., 92103. "Bill and I were fairly closely associated during the early days. We both came from Massachusetts, both took Course X, and after graduation, we were M.I.T. Assistants in Dr. Sherill's Laboratory (Theoretical Chemistry). Somewhat later, Bill had a position with the Standard Aniline Products in Wappinger Falls, N.Y. and told me of another possible

opening there. So I joined him and we worked on dyestuff chemicals for about eight months. After that we went our separate ways although we have kept in contact over the years. Bill was associated with Charles Pfizer in Brooklyn for some years until his retirement after which he went to California to live."

Les Hamilton passed this note along: "I read in the news edition of the American Chemical Society that **David Gould** died on July 26, 1970." Our records show that he was associated with the Research Laboratory of the Borden Company. His home was in Summit Road, Burlington, N.J. 08016.

We received a letter announcing the death of **Alfred W. Devine:** "Dear Mr. Affel: I regret to inform you of the death of my father, Alfred W. Devine, a member of the class of 1914, on Tuesday, December 1, at the Malden Hospital. He was 79 years old and had lived in Malden for the past 55 years. He retired in October, 1961, as Deputy Registrar of Motor Vehicles for the Commonwealth of Massachusetts. His initial employment with the State was in 1916 as an Investigator-Examiner under the old Massachusetts Highway Commission. He was appointed Illuminating Engineer in the newly formed Registry of Motor Vehicles in 1920, later was named Automotive Equipment Engineer and was named Assistant to the Registrar in 1929. He became Deputy Registrar in 1947.

"He set up the Equipment Section of the Registry and handled technical problems including the design and production of number plates. He was also in charge of Registry Branch Offices. In 1932 he was given a leave of absence to assist the State of New York in the organization of their Motor Vehicle Bureau. He was a member of the joint committees representing the states and the auto manufacturers which set up standards for sealed beam headlight performance and for the new international number plate size. His affiliations included the Illuminating Engineers Society; Society of Automotive Engineers and Chairman of its New England Section, 1933-34; American Association of Motor Vehicle Administrators and the American Standards Association. Mr. Devine was the husband of the late Mary (Sanborn) Devine. He leaves his daughters, Mrs. Mary Thompson of Wenham and Mrs. Ruth Walsh of Malden; and his sons James V. of Longmeadow and Harris A. of Long Valley, N.J. and 12 grandchildren. . . . I thought you might like this information for your class notes column in the *Technology Review*. Sincerely yours, Mary D. Thompson, 22 Puritan Rd. Wenham, Mass."—**Herman A. Affel,** Secretary, Rome, Maine. P.O. address: RFD 2, Oakland, Maine 04963

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The annual trek of the northern "Snow Birds" to the alleged sunny South has begun with **Whit Brown, Charlie Calder, Vince Maconi, Jack Dalton, Harvey Daniels, Boots Malone** and **Jim Tobey** with their families, who are on their way to Florida at this writing. Maybe there are some others we haven't caught up with. Ah, me! Well, just for that, when you are reading this column Fran and I (hopefully) will be cruising the blue Caribbean waters on the Canadian Pacific *Empress of Canada*. What a relief it is to get away from this disagreeable New England winter. . . . **Ernie Loveland** went from that New York hospital to his sister's in New Jersey to recuperate and eventually made it back to his home in Marion, Mass. He had hepatitis and is in St. Luke's Hospital, New Bedford. He contracted this out in the Philippines and it's a pity, for he has made such a remarkable and determined fight to recover. When permissable, Charlie Norton and I will try to see him.

The modest old Pirate has come in for a well deserved recognition and honor. A recent Belmont, Mass., paper carried this story. "At a luncheon held at the Sheraton Plaza Boston, on October 19, **George T. Rooney** of 49 Hill Rd., was elected an honorary member of the Boston Executives' Association. Mr. Rooney received this honor in recognition of his service to this organization both as former president and director. The Association is a group of Boston executives who meet regularly to discuss and exchange business opportunities. Mr. Rooney is a graduate of M.I.T., class of 1915. A Civil Engineer, he worked for some time on the Holland and East River Tunnels in New York. Since 1944 he has been president and treasurer of his own construction company in Cambridge. He is a registered professional engineer in the Commonwealth of Massachusetts. Mr. Rooney was one of the first to help organize Belmont Little League and is a former member of Belmont Rotary." Congratulations and best wishes to George. Our Class could very well give him another award for his always willing, helpful and substantial guidance and support that he gives me. Many thanks, George.

Congratulations to **Fred Vogel** for this honor and award. "The Institute of Electrical and Electronic Engineers (I.E.E.E.) regularly honors through its program of awards outstanding people in a number of technical fields of special interest to its membership. Its members, numbering more than 160,000 around the world, make the Institute the world's largest technical society and a nonnational organization. The William M. Habirshaw Award, which marks outstanding contributions in the field of transmission and distribution of electric power, is made to Fred J. Vogel, "for outstanding contributions to electrical equipment development, electrical insulation technology, and industry standards resulting in increased reliability and major economies in a-c transmission and distribution systems." In 1919, Fred entered the employ of the Westinghouse Electric Company where he worked on the insulation construction of transformers of all sizes and types as built at that time. He did the experimental work necessary to establish the insulation clearances required during this period—up to 1933. In 1933 he was in charge of power transformer design, and later became a consulting engineer. In 1943, he became a professor at the Illinois Institute of Technology and continued his insulation studies there. He also did consulting work for the Allis Chalmers Manufacturing Co. He resigned the teaching assignment in 1951 and worked full-time for Allis Chalmers until 1961. Since then he has been a consulting engineer, doing much work for McGraw Edison Power Systems Division in Canonsburg, Pa. So, this is it for this month's column. Want more next month? Well, just "help Azel."—**Azel W. Mack,** Secretary, 100 Memorial Drive, Cambridge, Mass. 02142

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Our greetings to all and may you find interesting news of friends of yesteryear. . . . Another good letter from **Paul Austin** from San Francisco encloses an article from Bechtel Corporation (June 1970) with which his firm of Arthur G. McKee & Company is associated. It's about the Trans-Arabian Pipeline (Tapline) and will be available at the 55th reunion (June 8-10 at Chatham Bars Inn, in case you haven't heard). He writes: "When I opened this copy of *Bechtel Briefs* and looked at this picture of the 'Skyhook', I got a big thrill. In 1950 when I was project engineer on the Tapline construction, in the base camp of Ras-el-Misha'ab, I rode this cable car out into the Persian gulf (2 miles). It was operated by an Arab using a gas engine. The seat for the operator was only wide enough for one person, so I had to ride it sitting on the steel roof, with my head up between the two cables. Two miles out in the gulf was a pier, where ships unloaded their cargoes of pipe. The 'skyhooks' picked up the 30 inch pipe and brought it ashore where it was joined into three lengths, 93-feet long, and then loaded on trucks to be taken out to the 'firing line.' On that job I worked seven days a week, 14 hours a day for five days and 12 hours on two days, when I 'goofed off' and went to see a movie. The picture brought back pleasant memories even though the hours were long. As a matter of fact, there was no place to go and nothing to do but work." . . . A release from the M.I.T. office of Public Relations is of particular interest to our Class. "Charles Curtis Haag has been awarded the **Joseph Warren Barker** Fellowship in Engineering, at the Massachusetts Institute of Technology, it was announced jointly today by Dr. Irwin W. Sizer, Dean of the Graduate School, and Charles H. Schauer, executive vice president of Research Corporation of New York City. The Barker Fellowship, established by Research Corporation, a foundation for the advancement of science and technology, is awarded annually to a promising student for gradu-

ate study in engineering. The fellowship honors Dr. Joseph W. Barker, a member of the board of directors of Research Corporation since 1934, who served as president and chairman from 1945 to 1959. Dr. Barker graduated from M.I.T. in 1916 where he went on to receive a master of science degree in 1925. The award provides a fellowship of $6,000, plus a contribution of $2,000 to M.I.T. for its unrestricted use in connection with the fellowship."

After our note regarding **Ray Blakney** in last month's *Review* it was a shock to receive notice of his death via a *New York Times* clipping forwarded by Joel Connally, a note to the Alumni Secretary from the Reverend Williston Wirt (Class of 1921) and a west coast clipping, which we quote: "Dr. Raymond B. Blakney, 74-year-old former college president, author and minister, suffered a fatal heart attack late Saturday afternoon at Scripps College's Denison Library in Claremont. Dr. Blakney, 660 Alden Rd., Pilgrim Place, Claremont, was given oxygen and external heart massage by firemen but was dead on arrival at Pomona Valley Community Hospital. Dr. Blakney was an ordained Congregational minister and served as president of Olivet College in Michigan and president of Pierce College in Athens, Greece. His book, 'Lao Tzu' a translation from Chinese, was a Mentor religious classic, which sold over 250,000 copies. He also wrote, 'Meister Eckart, a Modern Translation.' Dr. Blakney received an S.B. degree from Massachusetts Institute of Technology and S.T.B. from Boston University. In 1941 Williams College granted him a D.D. From 1920 to 1927 Dr. Blakney taught mathematics and physics at Fukien Christian University in China. From 1928 to 1945 he was pastor of Congregational churches in Sanford, Maine, and Williamstown, Mass. He returned to China as a missionary in 1946 and he and his wife went to the Philippines as missionaries in 1949. Dr. Blakney was a former member of the Pilgrim Place board of directors' ways and means committee."

The "unsinkable" **Harold Dodge,** your secretary wrote me by typewriter the other day (early November) which is proof that he is on the mend, as that is his natural mode of communication but it was too tough when he first came back from the hospital. It confirms his report that he is progressing according to schedule but the schedule is a long one. All our correspondents wrote sending their regards and support for his morale.

Coke Flannagan writes from Inverness, Fla.: "After 17 years on our 12-acre place on the lake several miles out of town we noted each acre seemed to increase in size every year. So we sold out and bought an old house located in town on a ½ acre postage stamp. Since moving we have been constantly busy renovating the house and building a lawn. After we get into presentable shape, and assuming all goes well otherwise, I may get back into hospital or Red Cross work all of which I found to be both interesting and rewarding. However at the moment we are looking forward to the Thanksgiving visit of my son, daughter-in-law and two grandchildren and I feel sure they will keep Alma and me out of mischief for a while."

A reply to our plea for news was received from **Ed Hanford** from Hammond, Ind., as follows: "My daughter Carol, an honor student, transferred from the University of Kansas to Indiana University at Bloomington. Racial unrest at Lawrence was becoming too much of a problem. I spent the better part of the summer recuperating from a gall bladder operation at friends' vacation homes in Wisconsin and Michigan but am now back on the job." . . . From Eastham, on the Cape, **Freeman Hatch** keeps busy during the off season. He writes, "People ask me 'what do Cape Codders do in the winter time?' 1) Repair nine summer homes after the summer season; 2) Enjoy the open highways after summer traffic; 3) Leave things unlocked once more; 4) Baby sit for five great grandchildren (all are Hellions; 5) Wish I was in Florida; and 6) Wait patiently for announcement of the next reunion."

From Taunton, Mass., **Doug Robertson** writes as follows: "Your letter was waiting for me when I returned from a week's business trip to England and Belgium with my son who is in business with me. Bettina and I were abroad last spring at the time of the reunion. We do hope to make it next year. We joined the club of the burglarized the weekend before we went away. Now (we) are attempting to lock the door before all the horses are stolen. Looking forward to a southern trip Thanksgiving week and Montego Bay in February. I would be delighted to have any '16er look me up when passing through Taunton." . . . We had the pleasure of a call on **Elizabeth Pattee** at Meadow Lakes in Hightstown, NJ., while visiting other friends. She was charming, as ever, and seemed to be very comfortably located in that delightful retirement establishment, although she is still active. This recalls a clipping we have had in file for some time from the *Hightstown Gazette* of 2/19/70, noting that Mrs. Pattee, a retiree of the Business and Professional Women's Club, would be the guest speaker on the topic "Pleasant and Open Spaces." Her forte has been landscape gardening and she has participated in several international convocations both in this country and abroad.

A letter from **Vertrees Young** tells that he and Sylvia returned from their latest Safari last September and we quote: "Well, we got back safely and are darn glad to be at home again. Last night some friends and neighbors gave us a welcome home party in our rock house and garage, with all the refreshments provided by the three couples who staged it. About 80 or 90 people were there and it was quite an affair. Bogalusa has had another outbreak of racial trouble, this time in the schools. I don't know when peace and quiet will return to this community. The schools are completely integrated and the results so far do not impress one very favorably. A football team that was scheduled to play here Friday night refused to come. The blacks and whites get along well together playing football, but at a previous game fighting broke out in the stands, some of the blacks were suspended, and the blacks boycotted the high school the following Monday morning. Mrs. Phillips watched the fracas from our office window and quite a few of the students and several policemen were slightly injured. Sylvia and I are leaving September 25, for Hartford and then probably for a check of her eyes at Johns Hopkins.

"We had a marvelous trip this summer, visiting Southwest Africa, South Africa, Australia, New Zealand and Hawaii, collecting rocks and minerals all the way along our route. The big shipment has arrived by ocean freight from Cape Town and parcels are coming in every few days from Australia and New Zealand, most of them badly damaged in transit. There were about 800 pounds of mineral specimens in the shipment from Cape Town but I haven't yet gotten them all unpacked. I think I am going to have to add another room to my rock house or build some shelves in the garage—probably the latter. Sylvia and I hope to make the 55th reunion in June but it is too early to be certain."

The Sylvia and Vertrees Young safari's have been well and delightfully documented by many letters from Sylvia (your Secretary, Harold, has some 28 of them which will be available for perusal at our 55th—June 8-10, 1971, at Chatham Bars Inn—mark your calendar). In her October 23rd letter she reports on the presentation to Vert of the Eigenbrodt Cup Award for 1970 by Trinity College in Hartford, Conn., on September 25 and we regretfully limit the quote to the award as space for class notes is limited: "Born in Ohio, the son of a clergyman, the alumnus we honor tonight entered Trinity with the Class of 1915, but demonstrating the ability, character and perseverance that were to mark his future he completed his requirements for the Bachelor of Science degree in three years, earned membership in Phi Beta Kappa, and was graduated in 1914. During his busy undergraduate days, he found time to be an editor of the College paper and the yearbook, was a member of the football squad, was historian and secretary of his class and was orator at his commencement exercises. Two years after leaving The Hill, he received advanced degrees from both Massachusetts Institute of Technology and Harvard University. He has grown to love the state of Louisiana, where he was a highly respected business executive until his retirement in 1958 as president of a corporation he had served for 38 years. He has held high posts in state and national forestry associations and has held mem-

berships on boards, councils, and commissions—at local, state and national levels—far too numerous to record here. Still active, he has dedicated much of his energies in helping his adopted state to further its economic status, the well-being of its citizenry and to improve the relationship of man with man. With a deep sense of civic responsibility, this alumnus has steadfastly opposed racism with the zeal of more youthful opponents. Five years ago, he was cited nationally for his attempt to speak out against the bigotry that brought the threat of violence to his community. For distinguished service to the College, he was recipient of an Alumni Citation in 1955. In 1960, he was named a life trustee of the College and has served with diligence and distinction. The distance that he must travel to attend trustee meetings has been no deterrent. And when he travels to Hartford, he is often accompanied by his charming and gracious wife, who genuinely supports his interest and loyalty in this college—surely a sign of his domestic diplomacy. Fifteen years ago the community of Bogalusa, Louisiana, named this alumnus Citizen of the Year. Tonight his alma mater proudly names him Trinity Citizen of the Year and hereby presents him as the 1970 recipient of the Eigenbrodt Cup—Vertrees Young of the Class of 1915."

A letter from **Willard Brown** defied digesting so here it is in full: "When the contestants in the clean-air car race reached Cal Tech in Pasadena, the Los Angeles alumni group, to which I belong, held a dinner in the very nice Faculty Club, or whatever it is. Before dinner they had the cars and crews lined up out in a courtyard . . . we had the opportunity to talk with the crews and look over the cars. I was struck by the really large number of colleges which entered cars. Certainly the lads comprising the crews were good representatives of what the younger generation should be . . . most of them at any rate. At our dinner, I am sure there were no Cal Tech folks present . . . because as the President of Aeroscience took the podium to introduce the speakers, he brought the house down by speaking of Cal Tech as "Our western branch!" The two graduate students from M.I.T. who really organized the whole affair spoke exceedingly well. . . . Back years ago in G.E. at Nela Park I would have hired them both . . . after hearing them speak, etc. One of the wives, who had pitched in from the inception, did a very nice job of talking, too. All in all it was a delightful meeting . . . some 100 plus including a number of the alumni's wives. As it appeared there and then, the affair, its organization, and the carrying out of it, was a credit to our Institute. Incidentally, this time I was decidedly the "grandfather" of the group . . . usually at meetings in Los Angeles, there are one or two 1915 lads there. . . . *Never* have I encountered any of our classmates, though there are several closer than I! (Oh yes, I usually wear my cardinal jacket with its 1916 emblem to those L.A. alumni meetings . . . and usually have opportunity to tell about how it is now the 'uniform' of the 50-year class . . . etc. . . . not forgetting to mention modestly that we started the whole idea!"

A review of **Vannevar Bush**'s new book "Pieces of the Action", sent on to your secretaries, was too voluminous to report on except for a comment by Dr. James Conant, "A great book by an extraordinary man." Van also is reported in the *New York Times* of September 12, as receiving a patent for a compound hot gas engine (external combustion) which is superior to the internal combustion engine in its freedom from air pollution. The new engine is to be built in two stages operating at different temperature levels. Each has hot and cold cylinders connected by regenerators through which the sealed gas, usually helium, passes. Power is derived from the pressure of the moving gas on pistons. Van is also in the news as a member of a Committee on the Presidency appointed by the M.I.T. Corporation to recommend candidates to fill the office to be vacated by Howard Johnson next June. The Committee is also to reassess the structure of the office. In this regard your Vice President Joe Barker has sent a letter, endorsed by the Executive Committee of the Class of 1916, to Dr. Bush, with various suggestions for the committee's consideration. A copy was sent to all active members of the Class of 1916.

Bob Burnap writes from South Orange, N.J., "As to the news, life goes on with its ups and downs, but very little that qualifies for the class columns. Outside of a few chronic complaints and problems, Katherine and I enjoy reasonably good health but I am running low on steam. Taking care of the lawn and garden, repairing the household appliances, and keeping up with my reading helps to fill my days so that I never lack for something to do. More recently, I have been corresponding with a young Englishman regarding our Burnap ancestors. We have to go back to the early 1600s to find a common ancestor. I would like to get over more often to the class luncheons and hope I can make at least one this year. Since I have gotten out of the habit of frequent visits to New York City, the trip seems long and tedious."

From Lexington, Kentucky, **Dina Coleman** managed to find time to drop us a line, though from his letter some one of his activities must have suffered. There seems to be no slack at all. He writes: "For the past two years I have been occupied eight hours per day, five and one-half days per week, in the design and construction of a 'Shuttle' brick kiln and dryer. The cost to date is 50 per cent over my 1968 estimates, and the dryer is a big success. Now, the kiln is somewhat less than a success. However, I keep trying but have cut out that 44 hour week. In my spare time, I am still Vice President of the Board of Curators of Transylvania College and Chairman of the Finance Committee. I am still President of the Lexington Philharmonic Society—and that job is no bed of roses with money scarce and many people scared. Then, I am Chairman of the Board of our local Cerebral Palsy Unit. We are presently engaged in raising money for an adequate building. And 'so to bed' with an aspirin, and a vitamin capsule!"

From Seal Beach, Calif., we are glad to have a report from **Levering Lawrason** who writes: "It is hard to believe I have been in this Leisure World location for more than six years, but it is true nevertheless. I have three grandchildren in the California state colleges. Fortunately they are good students. When I stop to think of the difference in costs from what they were when we were going to school it makes me shudder. I suppose you read of our fires. They were really something, but when you have a humidity of 5% and a forty mile wind all you can do is get out of the way. We were fortunate it was not worse. My daughter's place in San Diego County was only five miles from that one."

Another miraculous escape from an automobile accident is reported by **Art Shuey** who writes from Shreveport, La.: "This year I attended Reunion at Miami University in Oxford, Ohio, so that Mildred could meet all the Ohio kin and old friends and we had a wonderful time. But coming home, on Interstate 65, just south of Bowling Green, Ky., while I was driving at 70 m.p.h., a car ran into the left rear of my station wagon and really ruined it. Driver fast asleep with foot on pedal. Fortunately neither of us were injured and after spending the day in settling insurance and buying a new car we went on to a week on the Florida beach with son Henry's family. In August we drove out to Colorado for some music at Aspen and some trout fishing in Crystal River at Marble, Colo. Results excellent in both places. We left when the first snow fell about mid-September. We have enjoyed Sylvia and Vert Young's reports of Safari Number 6 but will be glad when we can have a personal report. So sorry to hear of Hovey Freeman's death, another one of my old friends 'gone but not forgotten.' ". . . The old math is still useful to **Ralph Spengler** who writes from the Wade Park Manor in Cleveland: "One of the old boys who is a graduate of Case is always trying to impress me how fine a school Case is. One day I asked him when the centigrade and fahrenheit thermometers register the same. In his knowing way he said 'I will tell you something—they never do.' So I showed him algebraically that at —40° they were the same. I told him he had better go back to his school again. So now he no longer tells me how fine his school is. There are more ways of killing a cat than drowning it. Every morning and evening I call my sister. I tell her 'I am just calling to see if you are alive and kicking.' So far she has been. I am a little anxious as she lives alone."

You may remember when the Alumni Association sent out forms for contributions to the last Alumni Fund, they provided space for notes on your activities for your class secretary to appear in a

future *Technology Review*. Here are the returns that were forwarded to us: from **Val Ellicott:** "My wife, Mary and I spent 3 months in Europe, travelling for pleasure. I hope M.I.T. will succeed in pulling out of research on military technology."

From **Ed Hall**:—"I will be leaving for Florida about November 15-25 to spend about six months at our home near Marathon. Will give *Technology Review* due notice." . . . From **Ev Johnson:** "Health has been improving slowly but steadily this year and have been able to resume many activities. Was glad to find that the young man I was interested in (from Brookhaven, Miss.) is now in M.I.T." . . . From **Ralph Mills:** "Amateur telescope maker and astronomer; study of multiple stars, nebulae and planets. The northeastern section of the U.S. where I live is a very poor telescope 'seeing' area." . . . From **Shatswell Ober**: "Nothing to report." . . . And from **Fred Upton:** "Since my virtual retirement I have been busier than ever keeping this old house (no part less than 70 years old) and my tenant house in running order. Carpentry, painting, plumbing and electrical work besides a little gardening. In a 3-generation household things get in a 'mell of a hess'."

In conclusion your secretaries thank all our correspondents for supplying news of themselves and other classmates and urge you to keep it up. Write as little or as much according to the urge but write often to:—**Harold F. Dodge,** Secretary, 96 Briarcliff Rd., Mountain Lakes, N.J. 07046; or **Leonard Stone,** Assistant Secretary, 34-16 85th St., Jackson Heights, N.Y. 11372

17

As these notes are written the distressing news comes of the death of **Kenneth E. Bell,** on December 16. He suffered a massive stroke and died in the Huggins Hospital, Wolfeboro, N.H. Services were held in the Community Church in Melvin Village. Memorial gifts may be made to the Modernization Fund of the hospital. Our sincere sympathy is extended to his wife Vera.

It is particularly pleasant to have word of a classmate whom we see and hear little of. Thoughtfully **Penn Brooks** gives us this news of **Paul Leonard.** "On the 24 of October Paul and Steve Leonard celebrated their 50th wedding anniversary at their Halcyon Farm, Lakeville, Mass. There were some 50 Leonards present, which is not surprising when you recall that Paul was one of 15 children and he and Steve have three daughters and a son of their own. One great-grandson (4 months old) came on from California. It was an inspiring family scene and their 17th century farmhouse, which has been in the family all these years, was full of zest and good family fellowship. Paul and Steve are well and Steve is even more beautiful than ever. She continues to teach Latin in a nearby school while Paul assists son John in running their large and successful farm operations."

Also thoughtfully Penn contributed, "Now a word about the Brookses. Most of the year we spend at our own Buxton Farm, Millboro, Va., with occasional visits to Boston. We have a herd of Hereford beef cattle, a few sheep, too many horses and our pond is alive with wild Canada geese, mallard ducks and some muscovies with lots of large-mouth bass below the surface. The decimal point of my responsibilities has shifted way to the left. I can spend half a day deciding whether to hang a gate on the left or right hand post. Last spring we were in Mexico for a few weeks where, of course, we saw much of Conchita Lobdell Pearson. We were sorry to have to miss the 53rd reunion at Northfield but hope to have better luck next year.

"Carol and I have decided to give up our apartment in Boston and make this the base of our operations. After 25 years of building up the farm we now want it to be our home. So change your address books to the above. Zip 24460." On inquiring of Penn about his mother he replied that she is reasonably well and had recently had her 102nd birthday. Her comment on this was "That is too many."

It was good to have a card back from **Ned Sewall** at Oneida, N.Y. His golfing foursome totals 309 years. In the winter his hobby is his Decoupage. . . . **Tom Meloy** comments on his post card, "Thought reunion time was in the spring." For some it is and accommodations are tight. We found that June reunions detracted from Alumni Day and also that foliage time with less crowded hotels has increasing appeal. However it will be June, 1972, for our 55th at Chatham Bars Inn, Cape Cod. . . . **Carl Adams** writes from Providence, R.I., of his live radio program over station WRIB of a short gospel message every Thursday morning at 7 a.m. He thinks this may appear inconsistent to those who may remember his profanity which originated in the organic chemistry thesis room where many were having difficulties. He knows, though, that God has been good to him and he appreciates the opportunity to repay even a little through this radio work.

There was a bright, cheery voice on the phone the other morning and there was **Ray Blanchard,** "Just calling to say hello and check on the number." . . . **Art Gilmour** wonders if anyone would be interested in buying a set of M.I.T. Wedgwood Blue dinner plates that he has. There are 12 of them inscribed "Massachusetts Institute of Technology 1930" and each bears the signature of "S. W. Stratton." The pictures are of the first home of M.I.T., the "Mercantile Building," Rogers, then on to show the Cambridge developing scenes. The plates are in excellent condition. Art will donate any revenue from their sale to the Buzz Aldrin Scholarship Fund. Anyone interested should get in touch directly with Art at 91 Concord St., Haverhill, Mass. 01830. . . . An interesting letter is received from **Vicente Checa Eguiguren** from Lima, Peru, which was written in response to our reunion notice. He had hoped to attend. It is inspiring that a man who has not been here since the 1920s can write as affectionately of his time and associates here and at the same time so enthusiastically of his native land, its great change in government, its needs and its opportunities for development. He extends a cordial invitation for our next "Melange" to be held in Peru assuring us that it would be most interesting. Enclosed was the front page of the newspaper *La Prensa* and, fortunately, Vicente's translation of the head lines and sub topics.

Here are address changes for Hartley B Gardner to 229 Robinson Rd., New Smyrna, Fla. 32069; Samuel H. Creighton Jr., to 2001 Greenbriar Blvd. #9, Clearwater, Fla. 33515; and Richard T. Whitney, to Building 1402, Apt. 104, Conway Gardens, Williamsburg, Va. 23185.

Enos Curtin and **Dick Loengard** upheld the honor of '17 at the December New York luncheon at the Chemists Club against three '16ers. . . . **Ray** (Johnny Appleseed) **Maeder** gave us warning at Northfield that this is probably the last year for his prize apples and pears as he has sold his orchard. . . . Heard at Northfield! **Noah Gokey** talking to two Mount Hermon school boys. Boy: "Is this some sort of a convention, you men in your red jackets?" Noah: "It's a reunion of the Class of '17 M.I.T." Boy: "Is that 1917 or 1817?"—**Stanley C. Dunning,** Secretary, 6 Jason St., Arlington, Mass. 02174; **Richard L. Loengard,** Assistant Secretary, 21 East 87th St., New York, N.Y. 10028

18

As you will note later in these class notes, we had a most enjoyable mini-reunion at Endicott House in November. In preparation for this event, I contacted as many of you as possible by telephone in the 50-mile radius around Boston. It was a pleasant experience to talk to many of you. I was, however, disturbed to find many of you at this stage of our lives, have infirmities or have wives who do. Since these situations preclude physical get-togethers with others of our classmates, perhaps I as your Class Secretary, can serve to bridge this gap in part, through these columns. So write me about what is happening to you, what you think about M.I.T., and in particular, your biography—all these news items are of great interest to us.

Now as to the mini-reunion. It took place on November 22 at the M.I.T. Endicott

House in Dedham. In a previous issue of the *Review* I described in some detail this magnificent estate. Our program started with a sherry hour, followed by a luncheon, then a seminar-type discussion of M.I.T., moderated by Professor Walter Rosenblith, M.I.T.'s Associate Provost; a beautiful color movie of a trip around the world with comments by Wingate Rollins, and finally a social hour.

Of particular interest was the talk by Professor Rosenblith, who envisioned new dimensions in M.I.T.'s future students who will receive training not only in science and engineering, as we all have experienced it, but will apply innovative methods to the new problems in urban affairs, environment and the management of health. Further, the future undergraduates may never formally graduate, but will continue their education by going out into industry and returning to the campus from time to time for further training to meet the changing problems of a highly sophisticated world. All of this made for interesting discussion.

Wingate Rollins and his wife had just returned from their world travels within the month. Their air plane pictures of the Himalayan mountains were spectacular. The social aspect of this reunion was most enjoyable to all of us . . . and, as we departed after a most relaxing but satisfying afternoon together, the universal theme was "let's do it again and soon."

The attendees included: Clarence Fuller, John Kiley, Wingate Rollins, Herbert McNary, Theodore Braaten, Charles Watt, Harold Weber, John Kilduff, Alfred Grossman, Julian Avery, Leonard Levine, Herbert Hatch, Julian Howe, Max Seltzer, George Sackett, and Eli Berman—all of these with their wives. In addition, the group included Edwin Harrall, George Ekwall, Edward Sidman and Charles Tavener, as well as guests Donald Severance and Professor Walter Rosenblith, with their wives.

If we had had prizes, the gold ribbon would have belonged to **Pete Harrall,** who came from 450 miles distant to be with us. . . . Anent Walter Rosenblith's comments about our being constantly retrained in a society that is experiencing rapid obsolescence, **Charlie Tavener** has retired as a manufacturer of valves, and is taking courses at Rutgers College in city planning—a new career and much success to you, Charlie! . . . Regrets were received from many of you, but with better planning for the next reunion, I look forward to a larger number attending a most pleasurable get-together. . . . A note from **Mal Baber** tells of a short vacation at Hilton Head Island, S.C.—soaking up the warm sunshine in preparation for a cold winter in Philadelphia. . . . Most faithful **Granny Smith** sent this note in from Sarasota, Fla. "Dear Max: Glad your 'sense of bond with the class of '18 is so keen' that you are planning a mini-reunion November 22nd and only wish we could join you there but time and space prevent our attendance. Once we have returned from our usual summer haunts in Maine, we become involved in civic affairs here and only brave the chilly clime of New York City or Boston in emergency. We maintain our bonds with M.I.T. with monthly meetings of our club, the next one (is) scheduled for the evening of November 17. One of my more rewarding efforts was helping raise money for New College located on the old Ringling estate near the airport, which has just celebrated its tenth anniversary with a formal reception attended by all the notables, including Senator Mark Hatfield of Oregon. Under the guidance of President Elmendorf, it has attracted students from every state in the union and has an enrollment of over 500. Then, I am involved in veterans affairs, head of Disabled Officers Association, Historian of Military Order and now preparing for annual 'Massing of the Colors.' Please remember me to all the '18ers who attend. I shall be with you in spirit on the 22nd. The only other '18er in this vicinity is **Harold L. Smith,** 1124 Palma Sola Blvd., Bradenton, Fla. He has never really recovered from a stroke two years ago. I keep in good health with golf and swimming in the Gulf daily.

New addresses include: Frank H. Appleton, Shaker House Rd., Yarmouth, Mass., Colonel Samuel Rubin, Remsberg, Long Island, N.Y., and Clarence D. Hanscom, Bedminister, N.J. . . . Keep the news coming to me.—**Max Seltzer,** Secretary, 60 Longwood Ave., Brookline, Mass. 02146

19

Nelson Bond visited **"Ren" Smith** at Lottshug, Va., for Thanksgiving and will be with his son in Schenectady, N.Y., for Christmas. . . . **Don Way** has moved to 846 Cedar Terrace, Westfield, N.J. 07090.

Word has been received of the passing of **Leslie A. Jackson** on September 26, 1970, at Little Rock, Ariz. . . . **Edward Adams Richardson** has been working on a book, *Light and Relativity.* It is limited primarily to a special theory and includes a suggested photon model for light and basis thereof. He has completed 17 chapters to date. . . . **Oscar A. De Lima** is one of three vice chairmen of the United Nations Association of the U.S.A. Earl Warren is chairman and the other vice chairmen are Amb, Earnest A. Gross, former Deputy Permanent Representative of the U.S. to the U.N., and Leonard F. McCollum, Chairman of the board of Continental Oil Co. . . . **Loyd R. Sorenson** and his wife Winnie left on November 16, 1970, for a three to four months' assignment for the I.E.S.C. as a shipyard consultant with Compania Colombian de Astilleros in Cartagena, Colombia, S.A. The assignment is similar to the one they had in Singapore in 1968, and gives them a chance to visit in South America. . . . October addresses were received for: **Richard S. Holmgren,** 1286 Discovery Rd., San Marcos, Calif. 92069 and for **Louis J. Grayson,** 200 L. St., N.W., Washington, D.C. 20036.

Your secretary attended the M.I.T. South Florida Club dinner meeting at Fort Lauderdale on November 19, 1970, with W. P. Doelger, '26, and Francis Kurtz, '22. **Ray Bartlett** of our Class was present; he lives in Fort Lauderdale.—**E. R. Smoley,** Secretary, 50 East Rd., Apt. 11E, Delray Beach, Fla. 33444; Phone 305-278-4537

20

Our dauntless classmates continue to move busily and happily around. Lucy and **Jim Gibson** are spending the winter in Sarasota and threaten to take a trip or cruise from there. . . . Barbara and **Bill Dewey** drove from their new apartment in Springfield, Mass., to Springfield, Va., to visit their children and from there will hibernate at Treasure Island, Fla. . . . Florence and **Lee Thomas** stopped by to visit Denise and **K. B. White** in Paris and found K. B. busily conducting a work simplification symposium. Lee reports that the Whites have a mighty attractive apartment in Paris in addition to their castle at Arthies. . . . **George Morgan** writes that he recently attended the annual meeting of the American Camellia Society in Wilmington, N.C. George is a vice president of the society and is justly famed for his camellias and orchids. He is Regional Chairman of the M.I.T. Educational Council and represented the Institute at a college night meeting in Beaumont, Texas. . . . **"Toots" Kinghorn** has moved from Carmel to the equally attractive town of Monterey, Calif., address 200 Glenwood Circle. . . . **Ed Burdell** is an active member of the board of the Winter Park (Fla.) Hospital, the only person over 65 ever to be elected. He supervises a training and education program and is helping to set up a cooperative research program in bio-medicine with Florida Technological University. Ed and Emma continue to be the Red Cross "twins." Emma is in charge of 3,000 volunteers and Ed is chairman of the Department of Service to Military Families.

"Bat" Thresher, who retired to Florida after serving long and honorably as director of admissions at M.I.T., is serving on a commission of distinguished educators to investigate and overhaul procedures for the College Entrance Examination Board. Bat advocates changes in SAT, the board's Scholastic Aptitude Test, in fact its eventual abandonment, preferring self-scored and self-administered tests that students can use mainly as aids to learning. His findings will no doubt be covered in the *Review.* . . . **Herman Marrow** is yet another Floridian doing volunteer work at the Sarasota Memorial Hospital. . . . **Jim Wolfson,** though he retired several years ago, finds himself anything but inactive. He divides his time between his local Peninsula General Hospital (Jim lives on Long Island) as director and chairman of the building committee which is embarking on a twelve-million-dollar expansion program, and serving as construction consultant on the

hundred-million-dollar New York University Medical School and Hospital. Jim and Gertrude are presently wintering in Mexico.

President Nixon has named **Percy Bugbee** to the National Commission on Fire Prevention and Control, a newly organized body charged with undertaking a thorough study of the nation's fire problems and report its findings and recommendations on ways to reduce life and property losses from fire to the President and the Congress. Perk will represent the National Fire Protection Association of which he is honorary chairman. During World War II he served as chairman of the War Department Advisory Council on Fire Prevention and was a member of the special board on fire prevention set up by the Undersecretary of War. Subsequently, he served on the Industrial Protection Council of the U.S. Office of Civilian Defense and on the Accident Prevention Advisory Committee of the U.S. Department of Health, Education and Welfare. He helped to organize the first International Conference of Fire Prevention Associations and continues as honorary president of the Conference.

Dave Kaplan writes that, like most of our classmates he has retired from business. His hobby has for many years involved amateur art and he has acquired a number of awards and honors in open exhibits. But, says Dave, modestly, "I am no match for a pro." Dave recently volunteered to serve with the New York Department of Consumer Affairs as an investigator and adjucator of consumer complaints. He and Evelyn are presently in Palm Beach, Fla. . . . **Clyde Hall** writes from Osprey, Fla., that he was one of many who attended the fall dinner of the M.I.T. Club of Southwest Florida. Clyde is a vice president of that thriving and growing organization, of which **Robbie Robillard** was president from 1967 to 1969. . . . Reunioners will be pleased to hear that Norrie Abbott gives an optimistic report on **Johnny Nash** and his improving health. The Class sends its unanimous good wishes, Johnny. . . . Also, for reunioners who enjoyed the hospitality of McCormick Hall, our favorite co-ed, **Dorothea Rathbone,** sends us an interesting clipping from the far off *San Francisco Chronicle,* as evidence, says Dorothea, that she is *not* the *first* woman to graduate from M.I.T. Dorothea is checking with the M.I.T. Women's Association to get the date on Ellen Swallow Richards whom she believes to be the first. At any rate the article in the *Chronicle* refers to Katherine Dexter McCormick as, in 1904, "said to have been the first woman to graduate from M.I.T.," married to Stanley McCormick, a Princeton graduate and son of Cyrus H. McCormick, inventor of the harvester. Mrs. McCormick who lived in California for some time (hence the story in the *Chronicle*) died in Boston only three years ago at the age of 92.

Our warm thanks to the many classmates who remembered the semi-centennial secretary with Christmas and New Year greetings, and a special salute to **Ming Pai,** who not only sent cards to all who attended the 50th, but enclosed copies of the autographs of those in attendance.—**Harold Bugbee,** Secretary, 21 Everell Road, Winchester, Mass. 01890

21

If you are counting the time to the 50th Reunion of the Class of '21, there are only four more months—barely 17 weeks to go—to that gala affair. You now have the tentative program and other details. The Institute will be our gracious host in providing McCormick Hall on campus as Class headquarters from June 3 through 7. Besides the various communications already sent, you will continue to receive later information if you have indicated to Reunion Chairman George A. Chutter (address at end of these notes) that you and your wife will probably attend. If you failed to do so, write George now or phone him at 617 385-3126. Don't miss this one and only major milestone in our Class history. Join '21 in 'Seventy-one!

More '21 honors

On the evening of February 24 in the Diplomat Hotel, Hollywood, Fla., the National Community Service Award of the Jewish Theological Seminary of America, New York City, will be presented to **Saul M. Silverstein** by the chancellor of the school. The accompanying citation stresses that the honor conferred by the board of directors and faculty of the seminary is in recognition of Saul's "distinguished record over many years in serving and advancing the welfare and strength of the general and Jewish communities through efforts on behalf of the seminary and other notable institutions and causes." Saul will be the guest of the theological school's annual convocation dinner.

Saul is touching down on the West Coast from foreign trip No. 29 as these notes are being prepared and his usual newsletters are beginning to arrive. They relate that he led several management seminars in Istanbul on "Social Responsibilities of Management in Developing Countries." He was invited to address the Istanbul Rotary Club, which exchanged club banners with the Manchester, Conn., group and he was honored with a gift as a dinner guest to whom the Turkish Management Association expressed its appreciation. He vacationed briefly in Crete. In Israel, Saul met General Moshe Dayan and his wife.

Modern transportation whisked Saul from Calcutta to Tokyo in 15 hours with stops enroute in Rangoon, Bangkok and Hong Kong. Business duties in Japan included participation in the December dedication of the plant of Rogers Corp. associate, Nippon Mektron, for which he had previously attended the June, 1970, groundbreaking ceremonies. Saul has moved his home from Manchester, Conn., where he lived for 40 years, to a permanent residence on Erdoni Rd., Columbia Lake, Conn. 06237, which for years has been his summer home. He continues active as chairman of Rogers Corp., Rogers, Conn. 06263.

Reunion directory revisions

New addresses have been received during the past month for a number of classmates and should be incorporated in your Class Directory listing to keep it current. Additional copies of the directory, mailed to you last June, are still available on request to your secretaries. We urgently ask you to complete and return the data sheet attached to the back of the directory if you have not

Laurence O. Buckner, '21

already extended us that amenity. . . . **Robert A. Eckles** has moved his retirement home to a new Florida address, Apt. 33W, Beacon House Towers, Naples, Fla. 33940. He was formerly a partner in the New Castle, Pa., architectural firm of W. G. Eckles Co. . . . **Julius Gordon** reports a local move to 521 Brentwood Dr., Wilmington, Del. 19803. . . . Laurie and **Henry R. Kurth** tell us they have moved their home from Beacon St., Boston, to 63 Pleasant St., Wolfeboro, N.H. 03894, where mail can be addressed to P.O. Box 894. Chick, who retired some years ago as vice president of Boston Edison hasn't told us whether the move also indicates a second retirement from his consulting labors with Jackson and Moreland, Boston. . . . **William B. McGorum** is back in Virginia after having lived in Florida. Address him at 109 N. Emory Dr., Sterling, Va. 22170. . . . Anne and **George Schnitzler** confirm their annual winter migration from New England to 1076 Venetian Way, Miami, Fla. 33139. . . . **Whitney H. Wetherell,** Carrier Corp. retiree living on Cape Cod, has a new address there at 1 Russell Dr., Harwich, Mass. 02645.

Reunion Chairman reports

The January letter from George Chutter gave you details of our golden anniversary celebration—a schedule of events, highlights, costs and related information. The list of probable attenders at that time totaled 281 classmates and wives. This is a segment that is highly representative of all our undergraduate and graduate courses, the dormitory units, fraternities, social, athletic and other groups. A high level of good fellowship is thus assured to those who do attend. This fact, plus the sheer enjoyment of the extremely varied program, should attract others who may have not yet decided to be present. George has requested prompt action from those who will attend, those who did not answer his earlier broadcasts and those who may require special information or assistance. Correspondence should be directed to him rather than to your secretaries to assure speedy attention. We do urge you to make your reservations at once as outlined in the material you have received.

Communicating classmates

One of the most heartening telephone calls we've ever had was made by Mary and **Laurence O. Buckner,** 2630 Durham Rd., Haines Acres, York, Pa. 17402. Mary and Buck called just after the oil refinery explosion in Elizabeth, N.J., to make certain that Maxine and your Secretary were not affected. We did hear the initial fireworks way down here on the New Jersey shore, but that was all. We learned that the retired sales manager of Metropolitan Edison Co. is working on a scheme to promote our 50th Reunion which he won't divulge at this time— in what little spare time he has between his consulting projects on wiring, heating and miscellaneous electrical equipment.

A cryptic note on participation in Alumni Association elections has followed a long letter from **Richard W. Smith,** 8713 Jones Mill Rd., Chevy Chase, Md. 20015, in which he tells of the several unfortunate illnesses both have had over the last two years which will prevent his attendance with Katherine at the reunion. Dick's compliments on our Class News are sincerely appreciated but modesty prevents repeating them. Since his retirement in 1963 from managership of the Chamber of Commerce of the U.S., Washington, Dick has been engaged in tracing his genealogy in New England— he is a native of Gardner, Mass.—and to English ancestors.

He adds: "My wife's background is more difficult to establish since she is from the South, where vital records were not kept until this century. I have found that she descended from Captain Thomas Graves, who came to Jamestown, Va., in 1608, beating my Mayflower ancestors by 12 years. From the surnames, I presume I may be distantly related to several of our classmates, including you and Sumner Hayward. I often see **Elliott B. Roberts,** since we are both members of the Cosmos Club. Recently, **Lawrence W. Conant** got Elliott and me to attend a luncheon meeting of the M.I.T. Club of Washington." The Smiths have a married son, a mechanical engineer and Duke alumnus, and a granddaughter.

Abram E. Watov, 1105 W. State St., Trenton, N.J. 08618, has sent regards via Sumner Hayward, advising that he is somewhat disabled and will await a doctor's decision on attending the reunion. He is spending the winter in Florida and may remain there permanently. In the absence of his personal data sheet, it can be reported only that he has retired from the N.J. State purchasing department.

Joseph Wenick and your Secretary attended the interesting evening tour made by the M.I.T. Club of Northern New Jersey to "Glenmont," onetime home of the Thomas A. Edison family in West Orange, N.J. The trip was sponsored by Ann and Theodore M. Edison, '23.

Anne and **Wallace T. Adams,** 2606 Fleming Rd., Middletown, Ohio 45042, are planning a trip to Nova Scotia following their attendance at the reunion. . . . Leila and **Samuel E. Lunden** invited 25 area classmates and their wives to a pre-reunion Christmas smorgasbord on December 13 at their home, 6205 Via Colinita, Miraleste, San Pedro, Calif. 90732. Following the repast, there was an informal session to get reacquainted, exchange experiences and to talk about undergraduate days and the forthcoming reunion. Leila and Sam deserve acclaim for their well-planned and generous contribution toward the success of our golden anniversary party. If you were present, please write us about the California reunion.

Louis Mandel, 175 Prospect St. East Orange, N.J. 07017, is spending the winter at Seacoast Towers, 5151 Collins Ave., Miami Beach, Fla. 33140. Lou retired in 1969 as president of Diversified Packaging Corp., Newark, N.J. and says he spends his time in travel and golf. In 1966, he married Roslyn Lowenstein of South Orange, N.J. . . . In September, Anne and **George Schnitzler,** 32 Gerry Rd., Chestnut Hill, Mass. 02167, noted they were looking forward to a trip to New Hampshire to photograph the fall foliage before planning their annual winter sojourn in Florida. George says: "It's a tough life," and adds: "Anne and I have had so much pleasure attending our Class reunions in the past that we are looking forward with a great deal of enthusiasm to the 50th reunion next June. We hope that a great many of our classmates and their wives will be able to attend this unique and most exciting event." So do we all, George!

We are sorry to learn of the illness of the wives of two of our number and suggest notes of cheer from you to speed them back to good health. **Albert E. Fowler, Jr.,** 432 Van Holten Rd., Somerville, N.J. 08876, says that Helen spent a short time in the hospital just before their return home from their summer place on Plum Island, Newburyport, Mass. Also **Edwin F. Delany,** 8 Welgate Circle, Wollaston, Mass. 02170, reports that Kay has been hospitalized and we hope she will be back to normal in time for the usual "hat" greeting at the reunion!

Eddie and **George Gokey, Jr.,** 98 Westminster Dr., Jamestown, N.Y. 14701, sent a card from Heidelberg, noting that they were on a "quickie" vacation and had taken the five-day cruise down the Rhine from Basel to Rotterdam. . . . Marion and **Philip R. Payson,** 5031 Northampton Dr., Tanglewood, Fort Myers, Fla. 33901, attended the dinner meeting of the M.I.T. Club of Southwest Florida, Sarasota, to hear a talk by Dr. Theodore H. Ansbacher, '60, now assistant professor of physics, New College, Sarasota.

Leonard R. Janes, 2520 Noyes St., Evanston, Ill. 60201, writes: "Retired from Commonwealth Edison Co. in 1961. My wife died in 1963 and I remarried in 1969—to Jeanette Lungren. Still teaching electrical engineering in Illinois Institute of Technology evening school. I am substituting in teaching mathematics in high schools in the surrounding area."

Norman Insley, 36 Old Middletown Rd., Nanuet, N.Y. 10954, who has retired from the technical staff of Bell Telephone Laboratories, adds a lugubrious comment: "Devoted the year to worrying. Aside from inflation, none of it happened, but hell sure broke loose in every other direction."

Class officers review

In mid-November a group from the Class had a most enjoyable session with representatives of the Institute in the spacious home of Helen and Class President **Raymond A. St. Laurent,** 47 Gerard St., Manchester, Conn. 06040. Present besides Ray for a full day's discussion and planning for our 50-year gift to M.I.T. were Kenneth S. Brock, '48, Director, and Martin M. Phillips, '47, member, the Amity Fund Board; Edouard N. Dubé, Irving D. Jakobson and Carole A. Clarke. Thanks to Helen and Ray's hospitality, it was a delightful occasion. Ray's increased mobility has enabled a switch from crutches to a pair of canes. Despite his own impatience, he is really making remarkable progress. Your notes and phone calls are a big help and encouragement. . . . There followed on the heels of the meeting the bad news of the painful automobile accident for **Ed Dubé,** veteran town official, in his home community of Reading, Mass. Ed is now home from the hospital and you can cheer him up by writing to 216 Woburn St., Reading, Mass. 01867, or by telephoning 617 944-1004. Our last phone call revealed that Ed is on the mend and in very cheerful spirits. At this writing, he is not yet able to resume his consulting engineering practice in Boston.

A note from Helen and **Robert F. Miller,** Rossmoor Building 50, Apt. 2C, 3386 Chiswick Ct., Silver Spring, Md. 20906, says they were in Mexico City for the birth of daughter Kathleen's first child, Raquel Marie Silverberg, on November 4, 1970. The Millers now have 14 grandchildren. Following the big event, they went north over a most attractive route through Tula with stops in Querétaro, San Miguel de Allende, Dolores Hidalgo, Guanajuato, Guadalajara, Morelia, Patzcuaro and then a jaunt to Acapulco before returning home.

Betty and **Sumner Hayward,** 224 Richards Rd., Ridgewood, N.J. 07450, left in mid-January for a winter vacation in Sarasota, Fla. Sumner sent us a number of notes on classmates, including the news that **Morris B. Hart,** 239 Lexington Blvd., Clark, N.J. 07066, is semi-retired from Hart Products Co., New York City, and spends his winters in Hollywood, Fla.

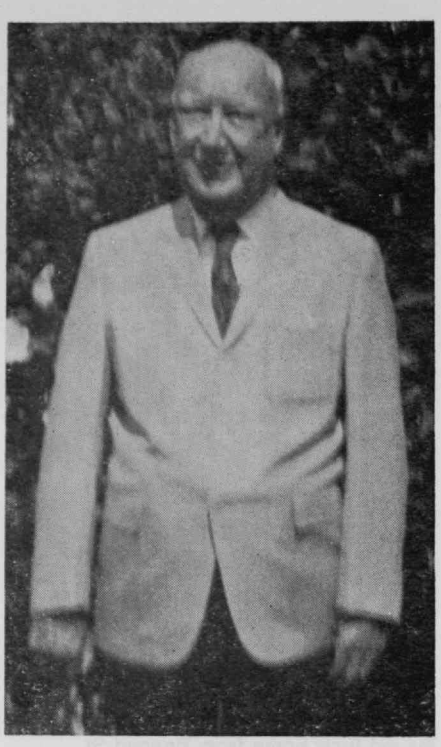
Abraham M. Aronson, 7 Exeter Rd., Jersey City, N.J. 07305, reported to Sumner that he had retired from a New York architectural firm. He has a son and three grandchildren in Minneapolis. . . . Pearl and **Horace B. Tuttle,** Park Ave., Bloomfield, Conn. 06002, wrote to the Haywards: "Don't get far from home. Guess we are homebodies with our 13 grandchildren and two great-grandchildren. We are looking forward to the 50th Reunion."

A note from Betty Patton, R.D. 2, Overbrook Rd., Dallas, Pa. 18612, wife of the late **Norman F. Patton,** says: "As of January 1, I leave my two architects after more than 10 happy years, to become executive secretary to the board of trustees and congregation of Temple B'nai B'rith, Wyoming Valley, Pa. A very challenging job with a great responsibility and I am most proud that I was asked." She and her mother are living together and enjoying the usual hobbies of knitting, needlepoint and gardening. . . . Josephine and **Willard C. Loesch,** 107 Kensington Oval, Rocky River, Ohio 44116, have written to Ray St. Laurent that they are wintering in Pompano Beach, Fla., and plan to see Ollie Bardes, Trev Peirce and Dick Windisch in the area. They will attend the reunion.

In Memoriam

Four classmates have left our ranks and it is with deepest sorrow that we extend to their families the sincere sympathy of the Class of '21.

William Charles Ready, 1904 Flora Rd., Clearwater, Fla. 33515, died on December 19, 1970. Bill was born in Lowell, Mass., on July 7, 1899, and joined us in the freshman year from Lowell High School. At M.I.T., he was a member and treasurer of the Civil Engineering Society; member of the Catholic Club, Track Team and finance committee. During World War I, he was a corporal, Infantry, in the S.A.T.C. at M.I.T. Graduating in Course I, he served as assistant city engineer, City of Lowell, and joined the Quartermaster Corps in 1923. He was variously deputy division engineer in Boston, New York and Baltimore. He also served as chief of operations and post engineer, Fort Dix, N.J. He retired from the Corps of Engineers in 1957 with the rank of colonel. His decorations included Victory Medals for both World Wars, defense and theater ribbons.



Col. William C. Ready (U.S.A.R.-Ret.), '21

Following retirement, he was resident engineer in Tripoli, Libya, for two years in charge of the construction of a power plant by the William H. Byrne Co. of New York City. He was a fellow and life member of the American Society of Civil Engineers. Other memberships included the Society of American Military Engineers; American Legion; the Clearwater Chapter of the Retired Officers Association and its past president; the Knights of Columbus and the Elks. Surviving is his wife, the former Martha McLaughlin of Patton, Pa., a retired major, Army Nurse Corps. Classmates Melvin R. Jenney and Edwin F. Delany represented the Class of '21 at services in Lowell. We greatly appreciate the courtesies extended by Mrs. Ready in advising of Bill's passing and the assistance of his Florida neighbors from our Class, Philip R. Payson and Colonel Victor S. Phaneuf.

Max Bernard Pearlstein, 73 Gerry Rd., Chestnut Hill, Mass. 02167, died on October 5, 1970. Max was associated with us in Course I. In World War I, he was an apprentice seaman in the S.N.T.C. at M.I.T. He had maintained his own building and remodeling company in Boston before association with the Boston Showcase Co. as purchasing agent. He retired in 1964 as general manager of the company.

Leland Hazelton Hewitt, retired Army Colonel of 919 E. Kerbey Ave., El Paso, Texas 79902, died on March 31, 1964. Born in Northwood, Iowa, in 1895, he attended Iowa State College and was graduated from the U.S. Military Academy in 1918. He was associated with us in the senior year, receiving a bachelor's degree in Course I. He served as captain, Corps of Engineers, in Manila and later was graduated from the Army's Command and General Staff School, Fort Leavenworth. He had been district engineer in Galveston, Washington, Seattle and Boston. During World War II, he commanded air field construction on several islands in the Pacific, where he was wounded in combat. His decorations included the Silver Star, Legion of Merit and the Purple Heart. Following retirement, he was appointed by President Eisenhower as American member of the International Boundary and Water Commission, administering the treaty between the United States and the Republic of Mexico covering flood control and irrigation projects, chiefly on the Rio Grande River.

Henry Hutchings, Jr., retired Army brigadier general, of 204C Ruelle St., San Antonio, Texas 78209, died on June 26, 1963. He had been associated with us in the senior year, following his graduation from the U.S. Military Academy. He received the S.B. degree with us in Course I. He served as district engineer, Corps of Engineers, in New Orleans and Dallas and with the 8th Engineers. He was the holder of the Distinguished Service Medal, the Legion of Merit and the Silver Star. We acknowledge aid from classmates Richmond S. Clark and Wilburn H. Henderson, retired Army major, in supplying information regarding General Hutchings and Colonel Hewitt.

Join '21 in 'Seventy-one!
There's just one set of dates for you and your wife to remember—June 3 through 7, 1971—for the 50th Reunion of the Class of '21 and Homecoming '71, headquartered for us on campus in Cambridge thanks to the generosity of M.I.T. You can still make our outstanding one-in-a-lifetime celebration if you will notify George Chutter and make travel arrangements promptly. Ask George for copies of previous mailings if you do not have them. Your secretaries still have not received the courtesy of assistance from a number of classmates who have so far failed to return the personal data sheet which was attached to the Class Directory that went to everyone on the Class list. Relax; take a break from your busy schedule, fill out the sheet and squander a six-cent stamp to mail it to us right now. Ask for another blank, if needed. Help! Help!—**Carole A. Clarke,** Secretary, 608 Union Lane, Brielle, N.J. 08730; **Edwin T. Steffian,** Assistant Secretary, Steffian, Steffian and Bradley, Inc., 19 Temple Place, Boston, Mass. 02111; **Sumner Hayward,** Assistant Secretary, 224 Richards Road, Ridgewood, N.J. 07450; **George A. Chutter,** 50th Reunion Chairman, Box 305, Boulder Drive, East Dennis, Mass. 02641

Reunions 1971

60th	'11	Oberlin S. Clark 50 Leonard Road North Weymouth, MA 02191	M.I.T. Campus
55th	'16	Ralph A. Fletcher Box 71 West Chelmsford, MA 01863	Chatham Bars Inn Chatham, Mass.
50th	'21	George Chutter Boulder Drive Box 305 East Dennis, MA 02641	M.I.T. Campus
45th	'26	Donald S. Cunningham 35 Talbot Street Braintree, MA 02184	Chatham Bars Inn Chatham, Mass.
40th	'31	Ralph H. Davis 66 North Street Lexington, MA 02173	Bald Peak Colony Club Melvin Village, N.H.
35th	'36	Henry G. McGrath 409 Wayne Terrace Union, N.J. 07083	Jug End (Berkshires) South Egremont, Mass.
30th	'41	Edward R. Marden Edward R. Marden Corp. 280 Lincoln St. Allston, MA 02143	M.I.T. Campus
25th	'46	Edwin Tebbetts N.E. Mutual Ins. Co. Actuarial Dept. 501 Boylston Street Boston, MA 02117	M.I.T. Campus
20th	'51	Jay Rosenfield 3 Bartlett Street Marblehead, MA 01945	Provincetown Inn Provincetown, Mass.
15th	'56	William S. Grinker 21 Woodward Road Framingham, MA	Harbor View Hotel Edgartown, Mass.
10th	'61	Dr. Jerome H. Grossman Massachusetts General Hospital Lab of Computer Sciences Boston, MA 02114	M.I.T. Campus
5th	'66	William H. Byrn, Jr. 995 Massachusetts Ave. Arlington, MA 02174	M.I.T. Campus

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Well folks, we played golf in Buffalo for the first three days of December but have been discouraged lately by two inches of snow. Many of our friends are going south but not until winter arrives here in January. This reminds us of the M.I.T. Mexico City Fiesta March 11 to 13. **Parke Appel** has announced that he and his family will be there and also at the Hotel LaPesca in Acapulco.

Parke has sent out a most interesting report on the Class Meeting at the Institute in October. Over 30 members of the Class attended. The meeting was endorsed by an equal number who were unable to make it due to conflicting commitments. The entire day at M.I.T. was spent discussing the Draper Laboratory, the office and classroom disruptions, campus discipline, the drug scene and student participation in governance and curriculum. Dr. Killian, President Johnson, Dr. Wiesner, Professor Gray and nine other senior members of the faculty and administration participated at various times of the day. In a final summation of the subjects and points of discussion, those attending suggested 15 resolutions covering the topics investigated including endorsements of statements on conduct and discipline already noted in the general catalog.

Many of our Class were among the 600 Alumni and wives attending the 1970 Alumni Officers' Conference on October 16 and 17. A later meeting of the Alumni Council included Parke Appel, C. Yardley Chittick, Oscar Horovitz and Robert Tonon.

Oscar Horovitz of Newton has just won his 96th and 97th awards in national and international amateur motion picture competition. His film "Rangoon Prays and Plays" was selected in Malta as the best travel film and his "City of Klongs and Gods" was one of the ten best selected in the Christ Church, New Zealand International Amateur Film Festival. Oscar was recently elected an honorary member of the Boston Camera Club, the second oldest camera club in the United States.

Dale Spoor, of Richmond, never fails to remind us of the future large participation requested in the Alumni Fund. As our Class Agent, he predicts that we will substantially exceed our goal in 1971. Of course this all applies on our 50 year gift in 1972. Thank you, Dale, for these tremendous efforts in our behalf.

We have been boasting about the Class of '22 by showing a picture which appeared in the *Atlanta Journal* of June 28. This shows **Elmer Sanborn,** 70, crossing the finish line in the mile run of the Carling-All-Ages-Track Meet. Elmer has had his headquarters in Atlanta since 1934 as a technical representative for Union Carbide. He tells us that, "since retirement my wife Betty and I have criss-crossed the United States several times with our camper trailer, from Maine to San Diego, and from Seattle to Key West, and we've hit the high spots in Canada as well. Last year after returning from the M.I.T. Fiesta in Mexico City, we learned that my son, Elmer, Jr., was to be married in California in December, so we found ourselves right back out there again for the second time in the same year. Our daughter Patricia (Pat) was brought up here in Atlanta, but we sent her to Denison University in Ohio where she met and married a fine young man from Rochester, N.Y., where they are now living. I was born and raised in New England, and my wife, whom I met in Cleveland, Ohio, was originally from Omaha, Neb., so altogether our family has pretty well covered the country. We have no grandchildren yet, but are still hopeful. Since retirement I've returned to my old hobby of running, and have become as much of a 'track nut' as I was in the old days at M.I.T. As a Charter Member of the Atlanta Track Club, I've become involved in a good many high school and college track meets, as an official representing the blue, and have been induced to compete in special races promoted by the club and restricted to age groups of 50 and older. I keep in shape by running two miles almost every day with a friend who is 54, but I'm not as fast as I was in the old days at M.I.T. I assure you." Betty and Elmer will be welcoming us at the 50th Reunion. He will wear his track suit!

At the annual shore dinner of The Moles held in the grand ballroom of the New York Biltmore, **C. George Dandrow,** of Jaffrey Center, N.H., was honored and presented with a 25-year certificate. The Moles is a heavy construction industry organization composed of the nation's current leaders in this field or those formerly engaged in the construction of tunnels, subways, dams and foundations. They have listed George as a Life Member of the New York Building Congress and the American Society of Civil Engineers. His athletic career as Hammer-Throw Champion and Penn Relay record holder was reviewed as well as his active participation in great New York organizations including Junior Achievement and Boy Scouts. He received the Silver Beaver award in 1962 and still remains a member-at-large of the Scout Executive Board. They also told of "Lobster Dandrow" at the Press Box Restaurant of New York and of his many civic interests.

Martha Eiseman Munzer has been teaching, lecturing and advising in the field of environmental education. Her latest book, published by Alfred Knopf, is *Valley of Vision: The TVA Years.* Another book in preparation is *Block by Block: The Rebuilding of a City.* . . . **Edwin A. Gruppe,** formerly of Buffalo, retired from Niagara Mohawk Power Co. in 1958 and spent two years with the Metropolitan Development Corp. His three children have given him 12 active grandchildren. He is still enjoying his photographs of a trip to Europe in 1965 with the Metropolitan Opera Tour. His winters are spent in the Fort Lauderdale area of Florida. . . . Dr. **John W. Strieder** is now vice president of the American Association for Thoracic Surgery. . . . **Florence W. Stiles** writes: "I am alive and kicking, in good health but hindered by glaucoma, even though it's under control. I cannot drive after dark. However, I make good use of Concord's three good libraries; read the *Tech Review* from cover to cover; look up the interesting personalities mentioned by the *Review;* visit M.I.T. three or four times a year. I like to keep in touch—and have my own ideas on M.I.T.'s progress."

William W. K. Freeman is completing his seventh year of teaching Latin and Math since retiring as statistician of the Mutual Boiler and Machinery Insurance Co. His paper, "Teaching How To Study," has just been published by *The Classical Outlook.* Bill has concluded that "it's a great life." . . . **John L. Vaupel** has moved from Belmont to Boothbay, Maine, "the boating capital of the Northeast." He tells us that he is having a wonderful time golfing, boating, eating at various famous restaurants and spending some evenings playing bridge. He is working with a corporation of consulting engineers on piers, docks, boating facilities and land surveys and meets with the M.I.T. Club of Western Maine. . . . **Dwight F. Johns,** of Piedmont, Calif., has set a record for a man of 76 by painting the exterior of his two-story home.

The sympathy of the class is extended to the families of **George P. Whitten,** of Middleboro, Mass. and **Donald D. Stowe** of Ozona, Fla.

Among the new addresses received are: Professor **Edmund D. Ayres,** Santa Barbara, Calif.; **Mortimer C. Bloom,** Folkestone, Kent, England; **John L. Vaupel,** Boothbay, Maine, **R. A. Stone,** Clearwater, Fla.; **John G. Campbell,** Southbury, Conn.; **James R. Maxwell, Jr.,** Ormond Beach, Fla.; **William A. Clark, 2d,** Southbury, Conn.; **Edward J. O'Connor,** North Andover, Maine; and **Frank M. Didisheim,** Robbinston, Maine.

In January your secretary will be in Scottsdale, Ariz., for several weeks "on business" and in March the Buffalo Chamber of Commerce Trade Mission will require his presence in Central America. Perhaps our paths will cross in Mexico during this period. Good Health to all of you and lots of Vitamin C!—**Whitworth Ferguson,** Secretary, 333 Ellicott St., Buffalo, N.Y. 14203;—**Oscar Horovitz,** Assistant Secretary, 45 Gerard St., Boston, Mass. 02119

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The Class of 1923 is becoming very active in laying the groundwork for our forthcoming Class History which is scheduled to be completed by the time of our 50th reunion, and there is much interchange among the classmates by

both mail and phone. Steps are also being taken to strengthen our class organization and by the time this goes to the press, communications will have been issued regarding class matters to all our class members.

China Airlines' Chairman of the Board has announced the appointment of Brigadier General **Russell E. Randall,** U.S.A.F. (Ret.), to serve as U.S. Advisor. He has had long association with the people of Nationalist China dating back to 1944-46 when he served in the 14th Air Force. The General commanded Randall Raiders, a very successful group against the Japanese on the mainland of China. He has received three decorations from the Government of Nationalist China (U.S. decorations include the Distinguished Service Medal, Distinguished Flying Cross and the Air Medal with three oak leaf clusters). Following his return from China, General Randall has commanded the Lackland Airforce Base in Texas, served as U.S. Air Attaché to the U.S.S.R., and served as advisor to the Korean National Air Lines and to the American Bureau of Medical Aid to China. He became an active member of the UniComp's Advisory Staff for Far East operations in early 1970.

A note from **Thomas L. Powers** reports that he is still playing golf and has been visiting his daughters in Tucson, Ariz., and in Stamford, Conn. He is in the hotel business in Fargo, N.D. and says he is looking forward to attending his first class reunion. (I hope the rest of you will note this and do likewise.)

Lucille and **Fred Chirgwin** are owner-managers of Daggett Houses in Edgartown, Mass., on Martha's Vineyard. Although this is not the season to bask in the sun or swim in the ocean, they would enjoy hearing from any classmates planning next summer's vacation.

Gerald A. Fitzgerald was retired as Professor-Emeritus, Agricultural Engineering, and is spending 15 to 20 hours weekly at the old stand (University of Massachusetts, Amherst). He is engaged in collecting notes on transportation politics preparatory to writing a book to describe his rather revolutionary philosophy concerning how to reduce marketplace distribution cost and at the same time help the railroads. More power to you, Jerry. We will look forward to reading your book.

With regret, we received notice that **Joseph Nissen** died March 8, 1970, at the age of 69. He was a teacher of mathematics and physics at Rindge Technical High School in Cambridge, Mass. He had attended Rindge, himself, and was valedictorian of his class. He belonged to the Stein Club of M.I.T., the Harvard Club, Temple Israel Brotherhood and was an accomplished sculptor, exhibiting some of his works in Boston.

The contract which **Alfred Perlman** held with the Penn Central Transportation Company was terminated on November 30, 1970. Al was president of the New York Central before it merged with the Pennsylvania Railroad in 1968 to form the Penn Central, and he has recently been named president of the Western Pacific Railroad.

New addresses have been received as follows: Walter Dietz, Box 2265, Delray Beach, Fla. 33444; Chaplin Tyler, 2401 Pennsylvania Ave., Apt. 1014, Wilmington, Del. 19806; Hyman F. Marshall, 10300 West Bay Harbor Drive, Bay Harbor, Fla. 33154; Edwin J. Heap, 2576 Clematis St., Sarasota, Fla. 33579; Colonel H. H. Zornig, 625 Biltmore Way, Apt. 801, Coral Gables, Fla. 33134; John V. Jones, Petrolite Corp., 506 Olive St., St. Louis, Mo., 63101; Colonel Nicholas Kane, 6100 N.W. 70th Ave., Ft. Lauderdale, Fla. 33313; Clarence M. Bouis, Box 142, Kilmarnock, Va. 22482 Also received: Arthur L. Hill, 1341 Cary Way, San Diego, Calif. 92109; Clarence J. Odell, 405 Oleander Ave., River Park, Ft. Pierce, Fla. 33450.—**James A. Pennypacker,** Assistant Secretary, Long Hill Road, Essex, Conn. 06426; **Tom Rounds,** Secretary, 4 Deer Hill Dr., Danbury, Conn. 06810

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Let's start off this month with a high honor that has come to **Nate Schooler.** The very formal invitation reads: "You are cordially invited to attend a Testimonial Breakfast in honor of Nathan Schooler on the occasion of the presentation to him of the Israel Prime Minister's Medal." This was on a Sunday in December at a Long Island temple, and was in recognition of the long years of work he has put in selling Israel Bonds.

Having given the Caribbean and the Mediterranean a thorough going over, the traveling **Bill MacCallums** have now embarked on a see-America-third program. In September they were in Solvang, which sounds like a detergent, and as far as my *Rand McNally* knows, it may well be; in October they went to Yosemite; in December, Death Valley, an unlikely spot to get into the jovial Christmas spirit; and in the spring they expect to head east, specifics unknown at this writing.

Saro and **Al Roig** took a leisurely and luxurious cruise last fall on the *Queen Elizabeth II,* from New York across to the African west coast with a side trip to Victoria Falls, then up the east coast of South America and back to New York. Of course there were plenty of stops along the way, from the Canaries to St. Thomas.

The Bird Machine Company house organ had a charming picture of a smiling couple with the caption: "Mr. and Mrs. **Blanchard D. Warren.** We were very pleased to receive a visit from newlyweds Blanchard and Mary Warren on their way to Europe for an extended honeymoon trip. The Warrens stopped by to introduce Mary to Warren's old friends of pre-retirement days." The caption writer got a little confused between given and surnames, but there's no question it was Nicky (that D. is for Dominic), and it was the first we had heard of his remarriage.

In his Adirondack retreat at Rainbow Lake, **Julian A. Joffe** has produced a book, *Studies in the History of Civilization,* published in December by the Philosophical Library of New York ($8.95). The publisher's blurb on the jacket starts off: "The underlying thesis of this book is that man neither is, nor ever was, a sapient creature. He is, rather, the end product of the development of thumbs (Pollicidae) and should be described not as Homo Sapiens but as a weapon-making wise fool: Homo telafactor sophomoricus." Sounds as though Julian is using his retirement to good advantage.

Notes from the Backs of Envelopes
"Have developed many things on which other people have made money (lots of it). I have decided to manufacture and sell my new computer myself (Ken-Lab Inc.). Have rented 5,000 sq. ft. and am filling it with equipment and hope. Wish me luck." **Ted Kenyon.** We do indeed, Ted. . . . "Retired July 1 and settling down. No travel—had 15 European and R.T.W. junkets plus annual Caribbean visits. Aim to remain somewhat involved in shoe industry via free lance projects. Regards." **Bill Giddon.**

"Very busy after retirement from Brookhaven National Lab. as Research Administrator for Marine Resources Council part of Regional Planning Board for Nassau Suffolk. Also serve as technical member of A.E.C. hearing boards for Nuclear Power Reactor Licensing Hearing Boards. Right now on long case, Palisades Plant, Consumers Power of Michigan." **Clarke Williams.** Aren't there any boards or committees with short names any more? . . . And at last comes the answer to another query we raised some months ago, whether or not **Willard Woodin Van Allen** survived the cold Maine winter. "Still enjoying the leisure life on the Maine Coast." W. W. Van Allen. Short and to the point, but proof that he made it.

As these lines are written the Christmas cards are just starting to arrive. The first, from the **Clarence M. Cornishes,** has a plug for the big Fiesta on March 11-13. This year, in which Jim Killian retires as the Chairman of the Board at M.I.T., it is to be the "Killian Testimonial Fiesta." Jim and Liz will both be there, and Nish promises it will be the gala of all galas. As an afterthought, a line at the bottom of the card announces: "Grandchildren score—11!!" The population is still exploding south of the border.

Jocky and **Phil Bates** put in their usual stint of traveling last year, from Canada to Guatemala, but evidently the spot that made the biggest impression was

Nantucket. Guatemala was dismissed with one word, but Nantucket got a full page plus two drawings. . . . The **Gordon Harveys** have finally taken up residence in their new home "The Woodlands" in Fort Lauderdale, Fla., or at least made it their official headquarters. "Have established my winter home here. Originally planned full retirement 1/1/71, but my Commissioners have urged me to hold the reins for another year, so will be back in Stone House in early spring, plus trips back for important meetings." Having seen the beauties of that New York State Park along the Genessee, it's understandable why Gordon finds it difficult to tear himself away.

Lots of us find it difficult to tear ourselves away from one thing or another, but there always comes a time when it is inevitable. And so, with these words, goodbye.—**Henry B. Kane,** Secretary, Box 177, Lincoln Center, Mass. 01773

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This month the major portion of this column will be occupied by a guest columnist. A note from **Ben Oxnard** that came into my hands suggested that **Doc Foster** give us some highlights of his "European Adventures." Thanks to Doc's cooperation the results follow.

"As promised, I have prepared a brief statement regarding our trip this past summer. A travelog it is not, for I am certain many of our classmates have travelled to the places we saw, have spent much more time in certain areas and do not want to read of someone else's impressions and descriptions of these places. Suffice to say that we were on a three-week tour labelled 'European Highlights,' and it was just that.

"When asked what we enjoyed most of the many interesting things we saw, our reply varies with our mood on the occasion, for we enjoyed the entire trip. However there is one town and activity which perhaps not so many of our classmates have enjoyed, for only once each decade is it possible to visit Oberammergau in the Bavarian Alps when the famous Passion Play is being presented, and this we did. The town was, of course, crowded because more than 5,000 people come into town for each presentation. Housing and feeding this number appear to present a problem, but it is extremely well handled, and we found no problem in this respect. We were housed in the private home of a wood carver only about a three-minute walk from the playhouse and the center of all the town's activities. This provided a good opportunity to meet some of the townspeople in their natural habitat and this was a delightful experience.

"The Passion Play itself starts at 8:30 a.m. on the dot, continues to 11:00 a.m. and then a break for lunch and visiting shops. At 2:00 p.m. the second part of the performance begins and continues without a break until 5:00 p.m. I entered the playhouse with some doubt that I could stay awake through all this time. The play is based on bible history, the plot we have all known for years; the characters are all familiar to us, and the outcome of the play is well known to us. May I say I found the entire production most impressive and never did the time lag.

"On several occasions I had the feeling of being in Jerusalem rather than in a crowd of people seated in a large open-ended theater, resembling in many ways an airplane hanger building, viewing a play being performed on a platform open to the sky with mountains in the background. There are no professionals in the production. The 48 voice chorus, the 65 piece orchestra, and the 500 or more participants in the play are all native to Oberammergau. However, every one really lives his part and you leave the scene, regardless of your religious beliefs, with the feeling that you have gained much from the day's experience. Every member of the cast is carefully chosen from the townspeople, and several months before the first performance, which was on May 18th in 1970, each character begins to live the part, growing beards and hair as appropriate. The final performance was scheduled for September 30th. As one viewer is reported to have remarked, after seeing the play, it is somewhat surprising to come across St. John mowing the grass in front of his home.

"The costumes used are in keeping with those in the time of Christ and are most colorful. Through the play, there are many 'vivant tableux' which are well presented and add much to the day's experience. As to the town itself, we found it delightful and came away with the feeling that we would like to visit there again, even if the play were not being presented."

The following are a couple of miscellaneous items: **Paul Hess** retired early in this year from the Montgomery, Ala., based concern of Blount Brothers Construction Co. He was vice chairman of the board and expects to remain in Montgomery acting as consultant to the firm but also spending more time with outside interests. . . . **Benjamin A. Oxnard** was named as "Sugar Man of the Year" for 1969 and was presented with the Dyer Memorial Award for significant and meritorious contributions to the sugar industry. Among other achievements Ben revolutionized the consumer trade in 1937 by perfecting the multi-wall bag and bundle to replace the 100-pound cloth sacks.

With regret the following deaths are reported: Major General **John H. Stokes, Jr.,** of Menlo Park, Calif., on November 9, 1968; and **Arthur J. Olson** of Milton, Mass., on November 15, 1968.

Again let me say thanks to "Doc" for his appearance so soon as a guest. Until next month—**E. Willard Gardiner** (Will), Secretary, 53 Foster St., Cambridge, Mass. 02138

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Let's get back to our relaxed by-the-sea way of writing class notes. It's a good morning to do it since it is quiet with no breeze at all and a soft gentle snow is falling and immediately being swallowed up by the quiet sea. It is Pigeon Cove before Christmas. You may have noticed a stiffness and formality to the last few issues of notes—a sort of "let's get them written" tone. It was there and that was the objective. Why? Some of you may recall that your secretary has had a hobby business for more than 10 years, molding replicas of hand carvings (ships, eagles, etc.) from rigid polyurethane. Since "retiring" a little over a year ago, it ceased to be a hobby and has taken full time with nothing out for vacations. Then in the September/October issue of the *du Pont Magazine* we were given a write-up which led several companies to want to buy the outfit and on December 1, one did. But your secretary has an arrangement that will require continued attention to the business without the responsibility of management or ownership. We hope this explains much because not only have the notes been stereotyped but for a loyal '26 man to forget to attend a meeting of the 45th reunion committee is regarded as a heinous sin. A phone call from **"Pink" Salmon** said that he, **Don Cunningham** and **Bob Dawes** were sitting at the faculty club sipping scotch and sodas waiting for me to arrive. To add to my sins, about a week later I also forgot to attend the Alumni Advisory Council Meeting. All this in addition to the class notes seems to call for an apology, but I've given an explanation instead. And I don't promise it won't happen again because I'm so full of ideas I'm almost becoming a dreamer. Since your secretary was not present at the 45th reunion organization meeting there was no one to take notes. Furthermore, with a lag of two months in the publication of class notes, the reunion announcements will be the better medium for getting details to you. You should have such an announcement long before you receive these notes. It will be a great reunion since so many of the class have now retired that there will be greater freedom to travel from great distances. Your secretary has never been to Chatham Bars Inn but reports are excellent and other members of the reunion committee know the place well; they put a big stamp of approval on it.

Having returned to our rambling routine, we still must do a little reporting. A handful of those Alumni Fund envelopes with space for notes on the back arrived recently. So why not? "I will retire on 31 January, 1971, and come spring I expect to do considerable sailing in my new sail boat I acquired in 1970. **Cecil C. Ogren."** . . . "Retired as director of research for Raybestos Manhattan, Manhattan Rubber Division, as of De-

cember 31, 1968. Employed part time on the faculty of Jersey City State College a couple of days a week to keep busy. **Charles P. McHugh."** . . . "Tucson, Ariz., November 1970. We are still bumming around U.S.A. by trailer after a summer trip from east to west across Canada. In April we had our trailer destroyed by fire at Langtry, Texas, but had another trailer and underway again in eight days. Will be here for the month of November, then plan to spend the rest of the winter at Guaymas, Mexico. **Dwight H. Woods."**

"Enjoying my extra-curricular activity as violinist with the Brockton Symphony Orchestra, and now very busy as the symphony's chairman of the board. (My regular furniture business does interfere somewhat with the above.) Best regards. **Martin M. Fireman."** . . . "Present position —corporate safety co-ordinator, Eastman Kodak Co.—retiring January 2, 1971. Will continue living here, will continue on Building Code Council, New York State. **Allen L. Cobb."** . . . "Received Founders Award of the American Institute of Chemical Engineers at the annual meeting of the Institute in November, 1970. Attended the Convocation at M.I.T. on occasion of the 50th anniversary of the founding of the Chemical Engineering Department by Doc Lewis. Still working as a consulting chemical engineer with no plans of retiring. **Walter E. Lobo."**

A recent death has been reported—that of **Bill Graves** (William H., Jr.). We have no further information at this writing; perhaps we'll have some for a future issue.

The snow has stopped falling and we have a new toy in the garage (a 1971 Volvo). So if you will excuse, we will go out and play. Cheerio until March.—**George W. Smith,** Secretary, Pigeon Cove, Mass. 01966

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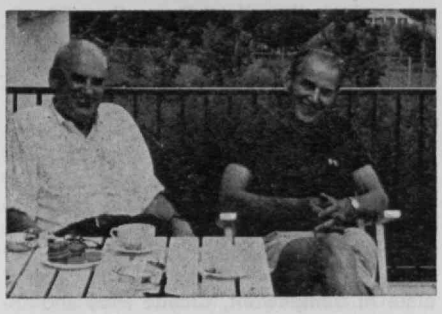
Robert Pennock of Honeywell, Denver, Colo., presented a new model Automatic Strobonar (#332), to Dr. **Harold Edgerton** during Dr. Edgerton's visit to Denver to attend the 9th International High Speed Photography Congress. The model was inscribed to Dr. Edgerton with the following legend: "$20\pm/10^{6}\pm$." This signifies that about 20 years have elapsed since his first visit to the Heiland Company (now Honeywell) with his strobe, and that about a million flash units have been shipped out of Denver since that time. This Strobonar features a rapid charge circuit which fills the portable battery in a matter of minutes. The flash unit is equipped with an automatic computer that extinguishes the light when the exposure is adequate. As soon as the new unit reached M.I.T. it went into an experiment for Dr. Edgerton's students in the strobe laboratory. The effectiveness of the automatic feature was tested as a function of lamp-subject-distance and the details of the light integrating circuit were investigated.



Kenneth A. Smith, '27 left, with Amund Enger, '27, at the Engers' home in Switzerland.

We have more information now—and a photo—from **Ken Smith** about his visit with **Amund Enger** in Switzerland: "Amund takes life easily, shoots a lot, plays golf and gets to Norway each fall for hunting ptarmigan. The past two times I was in Europe (in 1964 and 1965) I missed him and therefore was most happy to see him this time. As you can see from the photo, he has survived better than some of us. He has managed to keep his hair and while it is not the blond mop of years ago, it is not all grey either. His house is about 20 kilometers outside of Geneva and very close to the French border. The front of the house faces the Jura Mountains and from the terrace you look out over Lake Geneva at Mont Blanc in the distance. The Engers drive a couple of miles into France to the golf course. In winter they go skiing. It sounds like a good retirement; something which won't come to me for another three years. Our trip was the first time I have managed four full weeks away from the University since 1967. It was good to be away from the desk and the phone for that consecutive time. 'For the record,' Amund's correct address is La Rippe 1261, Switzerland. The number is like a zip code." Many thanks, Ken.

Bob Hancock, whom I failed to reach by phone when I was going through Jackson, Mich., by car, returned the call when he got back in town. Bob is well, has no immediate retirement plans, reluctantly agreed to send on a copy of Hancock Industries latest annual report. His modesty can be accounted for by the company's having shown an increase in profits when most were settling for a decrease. The company makes parking brake assemblies, window brackets, seat slides and many other auto components. Bob also wrote that **Frank Mesker** had been in the hospital. After having successful cataract operations, he developed detached retinas in both eyes. Here's hoping he recovers soon.

It was great to receive nine (9) messages this month written on the flap of the little envelopes in which you send your contribution to the Alumni Fund. Writing where it says "notes of my activities for the class secretary" is such a painless system. Postage-free, too. Apparently the idea was dreamed up by Chick Kane, Secretary of the class of 1924. . . . **Moe Smith** says he has moved to Christiansted, St. Croix, U.S. Virgin Islands, permanently. He and Jean are located in the "Seven Hills Area." Moe had been in real estate in Yardley, Pa. . . . **Joe Melhado** was scheduled for retirement in December. Just before that he was inducted into the Quarter-Century Club of Standard Brands. . . . **George Cunningham** says "retirement is fun" and it sounds like it from his message: "Betty and I have just returned from a seven-week trip to Japan and Malaysia, and visiting ceramic centers in Thailand, Korea and Singapore. I have completed my 6th term in ceramics and now can make some pretty fair pots. As head of the Community Concert Association of Laguna Beach and our chorale society, we enjoy a lot of music." . . . **Phil Darling** is "still banging along doing part-time consulting work and really enjoying it. Since the majority of my career has been in petroleum refining and petrochemical engineering, my work has included most anything but that. Included are such things as structural design for lifting a complete separator-compressor station (all piped up) from a barge onto an off-shore well platform." . . . About 15 months ago we had word from **Bill Erwin,** retired in Wilmington, N.C., that he was "outfitting a cabin-boat." The name of the boat is "Dolphin," he has now refurbished it, and is about to push off for a winter of cruising Florida waters. . . . **Grenville Gerrish**'s cliff-hanger continues: "I am hanging on as a part-time consultant for Diamond International and Joy Mfg." He has news that he is building a part-time retirement condominium unit in Melvin Village, N.H. . . . **Willard Felch**'s cliff-hanger has ended as he took "involuntary" retirement from A.T.& T. He writes that he is now "in the home maintenance business—maintaining my own home! Best regards to all and hope to make the 45th reunion." . . . **Jim Castner** had a fine visit from Ken Lord, '26, who summers at Saco, just 10 miles from Jim at Kennebunkport, Maine. Jim, in turn, visited **Stu Bugbee** at his summer home on Herron's Island, Christmas Cove, Maine. Jim has daughters at Bowdoin and Drew, and one in 9th grade. . . . Hadn't heard from **Walt Johnson** in a long time. He reports, "retired June of 1970 after about 38 years of service with the federal government in various engineering capacities, including Corps of Engineers, Coast and Geodetic Survey, T.V.A., Veterans Administration and U.S. Air Force; also four years of active service in World War II. Non-federal employment with United Engineers and Constructors, Stone and Webster, and Massachusetts State Highway Department." Quite a record! . . . **Reg Jacobs** has a new address at 53 Leicester Rd., Belmont, Mass. . . . So long, for now.—**Joseph S. Harris,** Secretary, Box 654 Masons Island, Mystic, Conn. 06355

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Last month we made brief reference to a news write-up on **Roberta** (Lovely) **Halligan** which appeared in the *Star-*

Ledger, Newark, N.J. on October 8, 1970. We received the same item from two separate sources. The theme is how a competent and determined young lady won her way to success and distinction in the professional field of public health. Roberta is now health officer for the Borough of Caldwell, N.J., and the state's only licensed woman health officer. Prior to attaining this position 12 years ago, she was laboratory director for the Montclair, N.J., Health Department. Among her many responsibilities, Roberta issues permits such as for plumbing installations and licenses for dairies, restaurants, and food stores. Her areas of interest include such diverse matters as mosquito, ragweed and rodent control and the investigation of dog bite cases.

It is not surprising that Roberta has long been an advocate of equal rights for women. However, she favors the more effective approach of appeal to reason and legality and has little sympathy for noisy demonstrations. This interest is reflected in the stamp collecting hobby she shares with her husband Edward. They have many stamps from around the world commemorating women's rights and opportunities. Roberta is president of the New Jersey State Association of Mosquito Extermination, a Commissioner of the Essex County Mosquito Commission and a past president of the New Jersey Federation of Business and Professional Women. She is listed in the first edition of *Who's Who in American Women.* From the two photographs in the half-page story it is apparent that Roberta is happy, enthusiastic, and has retained her youthful mien.

Lazare Gelin sent in a nice letter which pleases us particularly since he claims to be a poor correspondent and seldom writes to anyone. Quoting from his letter: "Last winter my wife accompanied me on a trip around the world. In Japan we got in touch with **Shikao Ikehara** and his charming wife with whom we spent a very pleasant evening in a truly Japanese atmosphere. I wish we could have stayed longer in Tokyo but I had a long itinerary and couldn't even visit the Osaka Fair. We went through Taiwan, Korea, Bangkok, India, Iran, Russia and spent the usual long time in Europe. On return I found that **Bob Krummel** had already retired from Consolidated Edison and that **Bill Murphy** was about to follow. We had a shindig for Bill and I met some of our other classmates at the party."

On the occasion of his retirement as assistant vice president of Consolidated Edison, Bill Murphy wrote his own report to Jim Donovan as follows: "I don't believe I have ever contributed any news for the class notes before, principally because so little that I have been involved in has been newsworthy, but a recent occasion had such a strong M.I.T. orientation that I thought I should fill you in on it. The date was October 30 and the event was a cocktail party to recognize my retirement from Con Edison where I have worked since graduation. You will enjoy the attached copy of the flyer announcing the affair. Four other '28ers have gone down the line with Con Edison since leaving Tech. **Bob Krummel** and **Ted Pierce,** who retired recently, were at the party; **Ernie Mason,** also recently retired and **Frank Stetson,** who will retire shortly, are the other two. Other classmates who showed up and obviously enjoyed the party were **Lazare Gelin, Bill McClintic** and **Bob Murphy. Hal Porter, Morris Klegeman** and **Jim Ure** came and brought their charming wives also. **Al Dempewolff, Claude Rice** and **Frank Sweeney** sent their regrets and best wishes.

"Two of the most versatile entertainers in the utility industry teamed up for the occasion: A. R. (Gus) Belyea, '23(X), contributed some of his highly personalized ditties which were sung to the piano accompaniment of C. W. (Wes) Meytrott, '27(VI). Herman J. Behrens, '29(VI), composed and delivered a somewhat colored, poetic review, in the Gilbert and Sullivan tradition, of my career with Con Edison. My long-time associate W. A. (Atherton) Thomas, '23(XV), rounded out the roster of M.I.T. personalities. Needless to say, it was a memorable occasion for me, and I am particularly indebted to Bob Krummel who spread the word among the local '28ers and made it possible for me to see so many of them. As for the future, I haven't really left Con Edison yet; I am back at work at the same stand—on a consulting basis. In a different vein, I read your recent letter attentively and want you to know that I, for one, am not giving up on the Institute!"

After returning from a recent business trip, Jim also sent in the following: "On the way to **Walter Nock**'s son's wedding I stopped in Columbus and called **Howard Batchelder.** His pleasant wife Chris answered the phone and told me more about Howard than most of us have heard since he graduated! They have two daughters; one married to a lawyer, the other to a naval airman. Both of them are located in San Diego. The grandchildren please our old classmate. Howard expects to retire from Battelle next year but, of course, plans to stay working part-time. According to Chris he expects to do a bit of traveling, fishing, and bridge along with his work. Chris wants more travel and, presumably, less fishing!"

In the letters column of *Newsweek* of October 12, 1970, there appeared a contribution from **Carl M. Loeb, Jr.** The point of Carl's letter is that it is basically wrong and futile to punish, by imprisonment as criminals, perpetrators of victimless offenses such as drunkenness. Carl, who is president of the National Council on Crime and Delinquency, urges revision of our justice system to handle such cases more intelligently. . . . A brief but very welcome note from **Doug Tooley** says: "Retired December 31, 1969. Drove across the country to find the least undesirable place to live and picked Rancho Bernado which is 20 miles north of San Diego." . . . Another short note, this one from **Kenneth Mackenize** (now retired) tells us: "Still traveling. Now planning our 23rd trip to Europe. Will sail about April 15, from New York on the Italian Line. At Naples we will pick up a car and roam through Italy and the French Riviera. Will sail back from Genoa about April 26."

We are very sorry to report at this time the deaths of two classmates. In each case the information has come to us somewhat belatedly. **Dexter W. Dimock** died on April 25, 1970. Our records show that Dexter had been retired for about 12 years. He enjoyed living on Bainbridge Island (in Puget Sound) and two years ago wrote enthusiastically of his yachting activities during summer months and trailering during the winter.

Daniel L. Edlund, who received his S.M. and Sc.D. degrees in Course III, died on July 23, 1970. Our file shows his recent address as 172 Highland Dr., New Concord, Ohio 43762.—**Walter J. Smith,** Secretary, 209 Waverly St., Arlington, Mass. 02174

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George White, Course VII, lives in Naples, Fla., with his wife Olive. He has retired after 38 years of service with General Foods. George started with "Minute Tapioca," working on the shipping platform through 10 different locations with manufacturing and development responsibilities. He was vice president of the corporation at the time of his retirement. George's activities include fishing, sailing, racing, cruising, golf, gardening and loafing. . . . **Morris Smith,** Course VI, of Los Angeles, Calif., writes, "I am still working away on Sky-Lab, hopefully the country's first space laboratory to be. This year I married off a daughter—in Israel, a beautiful and stirring country fascinating in many ways. Concerning January's (1970) disturbances at M.I.T., I have little sympathy for President Johnson's explanations, and *Review*'s acceptance thereof. It does not do our reputation any good."

A brief note comes from Professor **John Happel,** Course X, of New York. "During past summers, I visited German universities as a NATO Senior Science Fellow."

Sam Shaffer, Course XV, of Los Angeles, Calif., writes, "I am inching closer to retirement. Have relinquished post of treasurer at May Department Stores and have assumed the post of vice president in planning and research."

Professor **Gilman A. Randall,** Course IV, of Wilbraham, Mass., is an Associate Professor at the American International College, Springfield, Mass. Prior to joining to A.I.C., Professor Randall taught in the school systems in Ashburnham, Mass., and Hopkinton, R.I. A native of Whitman, Mass., he received a degree in architecture from M.I.T., a master's degree in mathematics education from Harvard in 1939, and also attended Columbia

University Teacher's College and Brooklyn Polytechnic Institute. He is a member of the American Association of University Professors, Association of Teachers of Mathematics, the Association of Higher Education, a branch of the National Educational Association, the Iota Chapter of Phi Delta Kappa, national honor fraternity of educators, and is an associate member of the Chapter of American Institute of Architects. He is the director of operettas in Wilbraham and is a church organist in the summer.—**Karnig S. Dinjian,** Secretary, Starlight Towers, Apt. 14E, 6000 North Ocean Blvd., Fort Lauderdale, Fla. 33308

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At this time of year the flaps on the Alumni Fund contribution envelopes provide a helpful source of information for your secretary. Entries on these flaps report a number of new retirements, as well as comments on the current activities of those who retired some years ago. From this source we learn that as of October 1, 1970, **Jack Bennett** retired as treasurer of Goodyear Tire and Rubber Co., after 40 years of service with Goodyear. Jack and his wife Anne plan to continue living in Hudson, Ohio, where they have many interests, but will spend part of the winter months at their home on Captiva Island, Fla. . . . **Allen Shepherd** reports from Woonsocket, R.I., that he retired from the Bostitch Division of Textron, Inc., about a year ago. However, he is continuing to do consulting work for Textron, as well as for Autel, Inc., "the poor man's Textron." He and his wife recently took a 42-day Mediterranean cruise on the S.S. *Rotterdam*. . . . **Rene LaPlante** retired from Hydro-Quebec in Montreal about a year ago, but apparently has continued to work part time under an arrangement expiring in January, 1971. . . . **Ed Giroux** retired about two years ago from his job on the staff of Newton South High School where he was a mathematics instructor. He is now "living the bucolic life in West Baldwin, Maine, where he and his wife Mildred have an art gallery. Ed reports that he recently sold his first painting. The Giroux' son Gerald graduated from Merrimack College in 1968 and is now with the air force in Vietnam. . . . From Franklin, N.H., **Mel Blackwood** reports that he is "still retired and living on Social Insecurity." His wife Leola "is working as a 3rd grade school teacher for which I encourage her every day." . . . **Irving Dow** retired from his Navy Department job nine years ago. He is currently "busy on a multi-descent geneological tree for co-relatives. I find my progenitors had a population explosion back in the last century. A lot of fun putting the parts of the puzzle in their proper places." . . . From Castine, Maine, **John Pratt** expresses regret for having missed the 40th Class Day. On that date his sister-in-law was running in an important primary election for State Representative, which she won. John is Republican Town Chairman and understandably felt that he had to be around and supervise things. He says that, "we were planning to fly down and back as a small cerebral vascular accident in January, 1969, has slowed my long trips by car to nothing. Wish we could have made it as it would have been my first! *Deo volente* the 45th!" . . . **William** "Cul" **Cullinan,** who until recently was Boston area manager for F.A.A., has been appointed manager of the Logan International Airport by the Massachusetts Port Authority which operates the airport. As previously reported in the Notes, during the early 1960s Cul was in charge of construction and development of organization and procedures for airport operation and maintenance at Dulles International in Washington. . . . **John Sherman,** who retired from the Technical Services Section, Toilet Goods Division of Procter and Gamble several years ago, recently spent three months in Korea under the program for assisting business enterprises in under-developed countries sponsored by the International Executive Service Corps. He advised the Lucky Chemical Co., Ltd., on their projects relating to the production of soaps, toothpaste and chemical products. . . . As previously reported in the Notes, **Max Wheildon** is chief of research and development of the Protective Products Division of the Norton Company in Worcester and has made important contributions in respect to flame-sprayed ceramic coatings, wear-resistant ceramic materials and ceramic tooling. He has been granted some 15 patents in these and other fields and has published numerous articles. He lists as his hobbies sailing, skiing, shooting, camping, building boats, guns and summer and winter cabins, including a summer place at Boothbay Harbor, Maine, "constructed with family labor." The Wheildons have three children: Andrea, who is a freshman at the University of Massachusetts; and William M., 3d, and Stephen B. who are in public school in Framingham. Max said that he would be happy to see any classmates at Norton Company or at their home in Framingham or at their summer home on Sawyers Island, Boothbay, Maine.

Changes of address: M. Richard Boyer, The Forge, R.D. #1, Pine Grove, Pa. 17963; James F. Biggane, N. C. State University, Industrial Engineering Dept., Riddick Hall, Raleigh, N. C. 27607; Dr. Cecil G. Dunn, Oxford, Maine 04270; Dr. Winslow H. Hartford, 1413 Redcoat Dr., Charlotte, N. C. 28211; Vito Janone, Box 23 No. Station, No. White Plains, N.Y. 10603; John J. Jarosh, 44 Hemlock St., East Walpole, Mass. 02032; Douglas A. MacDonald, 127 Cedar St., Sudbury, Ontario, Canada; Willard B. Paine, 6870 Via Estroda, La Jolla, Calif. 92037; Arthur D. Roberts, 24 Boulder Rd., Norwalk, Conn. 06854; Robert A. Sidur, Box 568, Chatham, N. J. 07928; Rev. Vincent I. Thormin, Apt. 508, 111 Wellington St. W, Markham, Ontario, Canada; Thomas R. Wigglesworth, 21000 McCanley Rd., Shaker Heights, Ohio; Cecil G. Dunn, 62 Taylor Rd., Acton, Mass. 01720; Wilfred P. Eaton, 50 Green Village Rd., Madison, N.J. 07940; Louis Harmantas, National Oceanic and Atmospheric Administration, National Weather Service, 30 Rockefeller Plaza, New York, N.Y. 10020; Wilfred F. Howard, 1969 Riverside Dr., Beloit, Wisc. 53511; Morell Marean, 221 Washington St., Marblehead, Mass. 01945; and E. Stephen Prendergast, 40 A Washington Park Dr., Andover, Mass. 01810—**Gordon K. Lister,** Secretary, 530 Fifth Ave., New York, N.Y. 10036

Dr. and Mrs. John Minami, '31 (left), with visiting '31 Class Secretary Ed Worden in Tokyo.

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While in Tokyo last November, I had the pleasure of having dinner with **John Minami** and his charming wife, Yoshiko, again. They are both in good health and gave me the above photograph taken not far from Mt. Fuji during an earlier visit. . . . **John McNiff** reports that they moved from West Roxbury to Kennebunk when Simplex Wire and Cable Company transferred operations from Cambridge to North Berwick, Maine. John's oldest daughter lives in Charlotte, N.C., where her husband is head of the Microbiology Department at U.N.C.C. His second daughter is at Argonne National Laboratory and his son is attending Catholic University. . . . **Art Sugden** says that his main job as vice president of the Long Island Lighting Company is reconciling power and environmental needs. His wife, Dr. Virginia Sugden is associate professor at Hofstra University. One son is a captain, U.S.A.F., and the other is in cancer research. . . . **Joe Buswell** and his wife are enjoying retirement (in 1965 after 33 years with the army engineers). He and Elenor took a two-year trip around the world visiting 36 countries by air, auto, bus, train, ship and on foot, covering 85,000 miles. Joe reports that no baggage was lost or misplaced during the entire trip and that of 45 flights, all except one were within 15 minutes of the scheduled time and the one that was late was only one hour behind schedule.

A note from **Elliot Whitaker** says that after completing 20 years as director of the School of Architecture at Ohio State

University, he is returning to active teaching as a professor of architecture.

Word from **Marjorie** (Holden) **Heath** tells of her retirement in January because she didn't like the prospect of commuting another winter 52 miles each day, some of it over hilly dirt road. She is enjoying her retirement, keeping busy at housework and correspondence as Governor of the New Hampshire branch of the Society of Mayflower Descendants.

Word of another retirement on July 7, 1970, came from **John Langmaid**—after 39 years with the S. D. Warren Company in Westbrook, Maine (now a division of Scott Paper Co.). . . . News from **Irving Finberg** tells of his teaching in Miami and would be pleased to have any of his classmates phone him when there at 989-4408. . . . Congratulations to **Ken Germeshausen** upon his election as vice president of the M.I.T. Alumni Association. . . . **Willis Fleisher** writes that he is preparing for the Intracoastal Waterway—South before too long. His daughter is married and after 5 years in TV news is now a full-time student at the University of Maryland Law School. His son is looking for a new connection after 11 years with Raytheon. . . . **Al Sims** was so impressed by the article in the April 1970 issue of the *Technology Review* on British Rail Research that he sent a copy to the Honorable John Volpe, Secretary of the Department of Transportation and received a most interesting reply from Mr. Volpe. Unfortunately space limitations prevent me from quoting the letter but if anyone is interested in obtaining a copy, let me know.

Word has just been received of the death of **William Volante** on January 17, 1968, and **Edward Pease** in September, 1970. Our deepest sympathy to their families.—**Edwin S. Worden,** Secretary, 35 Minute Man Hill, Westport, Conn. 06880

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Donald I. McSheehy retired as educational specialist—technical training U.S.A.F. in 1965 and is now teaching mathematics and science. His spare time for the past two years has been spent building his own residence at R#1, Box 20H, Fort Walton Beach, Fla. 32548. Now he can get back to his main sports of fishing in the Gulf and bridge. . . . **J. M. Shackelford** retired from Johns-Manville in 1968, to Raleigh N. C., where he has been employed by the state. His current position is research and planning officer in the State Retirement System which he finds a very lively area these days. He lives at 5008 Devonwood Ct., Raleigh, N.C. 27609.

We can speculate from the following address changes that there may be more retirements. George W. Falk from Leominster, Mass., to La Bonne Vie, Apt. 409, 3475 South County Rd., Palm Beach, Fla. 33481; Samuel G. Nordlinger from Washington, D. C., to 2525 Middle River Dr., Ft. Lauderdale, Fla., 33305; Harry F. Carlson from Belmont, Mass., to 28 School St., Hanover, Maine 02339. Ernest R. Steele from Belmont, Mass., to 100 North St., Bath, Maine 04530.

Juan F. Stalk, who was in civil engineering, sends best regards and good luck to all his classmates from Apartado 1844, Caracas, Venezuela. . . . **Don E. Corson** merged the Corson Electric Mfg. Corp. with Hyrotronics, Inc., and in 1970 moved the plant to Brewster, N.Y. 10509.

Henry E. Worcester, Jr., writes that he is still in the laundry and dry-cleaning business in Annapolis and Silver Springs. He has a few race horses trained by son Henry, 3d, and another son, Gerry, works in the business. His daughter Alice lives with her mother in Florida. Henry and his present wife sold their home after 11 years and moved into a high-rise apartment at 705 American Dr., Apt. 15, Annapolis, Md. 21403. . . .**Thomas R. Smith** is vice president, director of research and development, and a member of the board of the Maytag Co. He lives at 710 W. 11th St., South Newton, Iowa 50208. . . . Professor **Frederick R. Henderson** resigned his professorship last June at Rochester Institute of Technology and is now professor of data processing at the Community College of the Finger Lakes at Canandaigua, N.Y. . . . **John A. Robertson** was recently elected a member of the board of directors of the International Council for Building Research (CIB) and he is the official representative from the U.S. National Committee which is a body of the National Academy of Sciences. His new address is 3865 Wilson Blvd., Arlington, Va. 22203.

Professor **Rolf Eliassen** was appointed by President Nixon to a six-year term as a member of the General Advisory Committee of the U.S. Atomic Energy Commission. His appointment as environmentalist on the nine-man committee follows the 12 years while on the M.I.T. Faculty (1949-1961) during which he conducted research for the AEC on atomic wastes disposal and his work on environmental problems at Stanford University since 1961.

We regret to report the death on June 9, 1970, of Mrs. **John B. Traylor** remembered by our class as Helen Moody. Her presence at the Institute and her life after graduation have been of continuing interest to her classmates.

We must also sadly report the deaths of **John H. Ruggles** on July 9, 1970, in Ft. Lauderdale, Fla.; **Kenneth Hobart** in March, 1970, in North Swanzey, N.H.; and **John W. Hoover** on July 3, 1970, in Coral Gables, Fla.

Kenneth W. Smith, of 218 North Drive, Butler, Pa., writes that in his opinion the contents of the *Technology Review* have become too highly technical for at least the older alumni. Please permit your secretary a personal reply: When I approached 65, I cancelled all my professional journal subscriptions for the same reason. Now I find that I must read at least the *Review* to know what is becoming of that technological world I had a small part in creating. Stick in there, Ken.—**Elwood W. Schafer,** Secretary, Room 13-2145, M.I.T., Cambridge, Mass. 02139; **James Harper,** Assistant Secretary, 2700 S. Grant St., Arlington, Va. 22202

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Top billing, this time, to a fella who now breaks down and allows me to tell the story, our own **Bill Barbour.** Bill cannot be called a recluse, but he is extremely reticent and says so. Bill leads off with a personal note as follows: "This morning I flew Alicia to Silver Ranch near Jaffrey, and we rode horseback through the beautiful New Hampshire woods, and then, this p.m., we played tennis with friends indoors in Natick." This was written late in November. Many thanks, Bill, I appreciate your obvious reluctance in having the Barbour story appear in the *Review.* All this comes from a conversation with another classmate who asks why nothing appears about Bill when he is always mentioned as attending the Alumni Council meetings? So, heck, I just asked him and he came through.

The Barbours are a very active family, and are as follows: lovely Georgiana, and Bill, have two fine girls, Alicia, 13, and Gigi, 7, both of whom go to school in Concord, Mass. They all are enthusiastic sports minded people, what with skiing, swimming, riding, and tennis. Bill is also an enthusiastic pilot of his own plane, a Beech Bonanza. They fly to Nantucket for about a month every year, and (see above) also have the ranch at Jaffrey. Apparently Bill commutes to both places while the rest of the family make with the vacation. Bill ties up the Beech at Hanscom Field at Bedford, and who ties right near him but our old Course II friend, Joe Leto. Businesswise, Bill's work is rather unusual; he and his associates are consultants in the nuclear, and radioisotope fields. He manages the Association of Nuclear Instrument Manufacturers, an associated trade organization, and, sezzee, all of this comes through his former association with Tracerlab. It is apparent that Bill keeps both hands busy. Without previous permission, I have no fear in mentioning that Bill is an every time attendee at the Alumni Council, which is why my appetite got whetted. Further, it is bruited about that Bill is not the first of the family to graduate from M.I.T. Some say that he is the third. This is not a flat statement; just a provocateur. Bill, your many friends and classmates will appreciate your kindness in giving us this family info. Our best to that unusual and lovely family. How about once a year from now on?

We have another seldom heard from fella, **Pierre Du Pont,** and then only through news of his son, Pete Du Pont. **Bill Baur** found an article in one of the Delaware Valley papers reporting that Pete was elected as the only Delaware Representa-

tive from his state; a republican yet. I have two pictures of the young man, and one of them looks exactly like our own Pete as he was lo those many years ago. Pete IV graduated from Phillips Exeter, as did his father, but, he also went to Princeton, as did not his father (or many other Du Ponts). These fellas must be individualists. Golly, it has always seemed to me that Exeter could have had more of our class preparing for M.I.T. Pete and **Red** (Jack) **Williams** are the only ones of whom I know, who did go to Exeter (located in my home town). Pete IV, when asked about further political ambitions, made no comment other than that "campaigning every six years is preferable to every two years," so!

Some time ago, I received a press clip mentioning **John Wiley** in a most unsatisfactory way, too brief and too uninformative. So I sent the clip to John, asking him to fill it in. Comes now this: The 7th annual meeting, and technical display, of the A.I.A.A., held in Houston in October, went thus: There is an apparent need for traffic markets for vertical and short takeoffs & landings, especially in metropolitan New York. John suggests that environment and congestion problems make it imperative that an urban linked rather than an urban based STOLport is desirable, and further suggests that this means a STOLport located in the Jersey meadows in Secaucus, immediately adjacent to the North Bergen viaduct. Though John says nothing further, it is apparent that it is still mandatory that facilities must be provided for small craft, and vertical take-off helicopters at other than the major New York Airports. Jumping the fees for these small planes at LaGuardia and Kennedy has not solved that particular problem. Thanks John; it is a real pleasure and privilege to have a classmate sitting right on top of the airport situation in such a major port as New York.

According to Bill Huston, **W. Clinton Backus** was a cattle man in Southern California: 4,000 acres, sezzee. So, I wrote Clint a note on a Morgan Horse postcard, as a stab in the dark. Lo and behold comes now a fine, long letter from the handsome Clint. Y'all remember that curly hair? It turns out that the Backuses are, indeed, large land holders, but definitely not cattle people. To quote, "We did try feeding springing heifers, holstein, but ran into negative profits, and, the I. R. S. Then we bought a group of bred heifers to raise, and not one of them dropped a calf. We then decided that the cattle business is not for us (or I. R. S.)" On the brighter side, dirt farming has turned out much better, raising wheat, barley, sugar beets, and alfalfa, etc. It appears that the profits are very helpful in carrying the land. As mentioned in *Goodridge* 25, Clint is primarily an investor, buying and selling real estate and property; he also does some sub-dividing, and its attendant financing. He says, "This has been rewarding in more than a monetary way, though it might seem to be unimpressive to be known as the President of the 'Famous Blank' Corporation." This name is obviously a blanket name for many corporations. Clint married Audrey Royal in 1947, but, unfortunately, are not blessed with any children. When they married, the Backuses built a fine modern home in Bel Aire, and still live in it. They have a dog or two, a cat, squirrel monkeys, parrots, myna birds, and fish. Audrey is even searching for a gibbon.

Following graduation in 1933, Clint spent three years with the Matson Lines, then six years in the Navy Reserve, helping to build and repair carriers in and around Puget Sound. Following his stint in the navy, Clint got into his investment business, and now works at that, at least part-time. This observation is mine, as I can't conceive of this fella tying himself down to any full time job. To Clint and Audrey, many thanks for such a nice letter. Your classmates will appreciate getting this up-to-date word on the Backuses.

This last month, I put Leona on a DeLuxe Penn Central train for Florida, then spent a week driving to Florida, complete with all the baggage. I made a few calls, and talked via phone with some others. I had expected to have dinner with **Henry Kiley** (but the office said that Henry was sick) and with **Guido Garbarino** (Guido got the message too late). I was able to make connections with **Bill Baur,** Course II extraordinary. Bill was unable to assemble any more classmates, so we had dinner together with an after dinner drink at the Baur home. And I found out a lot about the Baurs, after lo these many years. I asked Bill if he learned his English in Germany. It seems that Bill spoke no English until after he landed in Boston, some years before he made M.I.T. Bill attended the Franklin Institute, Wentworth Institute, and finally, Lowell Institute, before entering M.I.T. In fact, his work at Lowell allowed him to enter the Institute without examinations. While at M.I.T., Bill made out by translating German to English for several professors in chemistry and chemical engineering. Fellas, this little guy paid his own way all the way through, supporting his good wife, Claire, at the same time.

Bill's son, Victor, took part in the M.I.T. organized clean air car race, from Cambridge to Pasadena, representing Lowell Technical Institute. Victor finished third in the overall competition (out of 40 college entrants). Governor Sargent, in addressing the Lowell School, said that he wished to congratulate drivers Victor Baur and Geoffery Mitchell, not only on their good showing, but on doing so well for their college, their state and their nation, in doing so much for presenting (creating most of it) a car which does not pollute. Sargent also said, "It is difficult for an M.I.T. man to address this group, especially as we M.I.T. men did not do as well. Sargent attended our School of Architecture.

While at Media, I phoned **Jim Norcross,** only to find him almost en route to the Far East. Jim does a lot of travelling, but I don't get reports.

I had intended to visit with **Bill** (Wilber) **Huston** in Bowie, Md., on my way south, but it was not to be. I stayed at a motel within a half mile of Bill's home, and could see the lovely subdivision in which the Hustons make their home. The little section is truly lovely. However, I phoned Bill's house, per schedule, first to thank him for making my reservation, and second, to ask them over for a libation. And, Bill had just taken off for California, on some unscheduled business, so, I talked briefly with his nice Dorothy, got the above info, and then had to go back to my lonely martini. Such is life, and happenstance. I had, from Bill, an invitation for dinner, but, had not any intention of accepting; first because I do not accept any such invites, and second, it is my conviction that, even though sincere, these classmate invites are not necessarily approved by the management. Haw! Bill has kindly furnished me with a complete report on his undertakings—I'll tantalize you with tidbits from time to time. Bill, and Dorothy, there are not enough selected words that could express my appreciation of your most fine and welcome letter. Who ever said that the class secretary has a thankless job? No such thing. My sincere thanks, and those of your classmates, go to you two most capable, charming, and neighborly people. Not enough sed, but, I am almost speechless with gratitude. Vaya Con Dias!

My final stop was in Allendale, S.C., on my southern trip, 70 miles away was **Tommy Fitzpatrick,** Course IV, eminent classmate. I phoned and found him out at a meeting, but enjoyed five minutes with the lovely Beverly, a friendly, cooperative, lovely girl, with the most enchanting southern voice and accent. These gals sure got it. Well, it seems that Tom is busy in Savannah about six months each year and then spends the other six in the garden spot of North Carolina, Highlands (right near the town named after one of our boys, Hendersonville). In Savannah, Tom is active in the Historic Savannah Foundation, as a civic venture, does some consulting, and even has a few private clients. I got the impression that he has it about as he wants it; busy enough to keep happy, and not too busy to enjoy himself as he goes along. So, I will try again, folks, and Tom, dang it, you really don't need to be home when someone like Beverly takes over for you. Many thanks to the Fitzpatricks.

We have one of our number who has been taken since our last report, **Robert** (Bob) **Swain,** former Class Agent, and friend of Ed Goodridge. Bob lost his life, if my source is good, in an accident, July 29, 1970. As in so many cases, Bob has been gone too long for anything but a report in the *Review,* and for inclusion in the Alumni Association's

kind handling of all such cases. Fellows, I again ask you in all sincerity, to let me know at once when you hear of the passing of a classmate. It is my policy to get in touch with the family at once, to let them know that the deceased really did have friends in his class and in the Institute.

Oops, I dang near lost sight of a very important note from our 40th reunion gift chairman, **Ellis Littmann.** Quite naturally, Ellis is reluctant to make predictions, but he can mention results; we are really on our way already having contributions and pledges in excess of $200,000; right around a third of our goal. Says Ellis, "We are pleased so far, of course, but, I am not forgetting that the final two thirds are going to be a lot tougher," so true, forsooth. Fellows, if ever a job were thankless, I suggest that this one of Ellis' is it. So far he has worked pretty much alone, but, very soon he and his committee will have to start digging deeper, and all of us will have our chance to pay back, to the Institute, some of that which we owe them. So please be kind to these fellas if and when.

Leona and I are back in Florida for our winter hibernation (see address below)—and don't ask me where is Hillsboro Beach; just look here. We are five miles north of Pompano Beach, on AIA; phone 941-0127. That's it, until your March issue hits the stands. Best to all.—**Warren J. Henderson,** Secretary, 1079 Hillsboro Beach, Pompano Beach, Fla. 33062

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This month I'm starting off like the old movie serials that were a Saturday ritual when we were kids. You will recall that my portion of last month's notes were written as Jane and I were en route from Norfolk down the Intracoastal Waterway. We ended up going as far as Charleston, S.C., a trip that lasted seven days. On the way we took a side trip up to New Bern, N.C., to visit Tryon's Palace—the colonial governor's home which had burned in 1789 but which, in recent years had been restored, a la Williamsburg. Thanks to finding a complete inventory of Tryon's possessions the restorers were able to furnish the house authentically—even to having 60 per cent of the books in the library the same editions as the originals.

It was amazing how our interest was maintained in the scenery despite the fact that it was not very spectacular. In a day's run we would be in swamps, marshes, small rivers, and cuts through forest land. The big surprise was the long stretches we covered without any sign of habitation except for an occasional drawbridge where a road crossed the waterway. We saw a goodly number of water birds—great blue heron, egrets, loons, and cormorants.

We spent two days in Charleston sightseeing. We found that a group of women have a guide service, picking you up in their own car and spending as much time riding around as you wish. Thanks to starting off this way, we got a good idea of the city and knew where we wanted to go to poke around on our own the next day. We had commitments back on the Cape so we left our friends to continue on to Florida by themselves.

My only news of class members comes from **Eugene Magenau** in connection with his Alumni Fund contribution. He writes: "For the past 10 years I have been engaged full-time in the field of large construction projects as president of Field Architect—an area which can benefit greatly from the type of qualified services learned in Course IV and subsequent years in private practice. Current project is an ambulatory patient center at R.I. Hospital, now about 20 per cent complete and costing $23,000,000."

In the July/August issue I mentioned getting a change of address for **John Hrones.** I inquired around about this during the October Alumni Officers' Conference and finally got word that the Alumni Association had confused father and son. It turns out that the Hrones that moved was son John, Class of '68. Sorry about that Johnny—at least now you know officially that you don't have to pack all your belongings.

I wish I were as slender as this month's notes have proved, but sometimes that's the way it goes.—**R. M. Franklin,** Secretary, Satucket Rd., Brewster, Mass. 02631

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It was good to hear from one of our former class presidents, **Walter Stockmayer.** Stocky writes from Hanover's snow-covered hills: "I have just finished reading the '35 column in the December *Review,* and am going to take a few minutes to answer your call for letters right away. First, I was sorry to hear you had to have the kidney-stone operation, but glad you have recovered on schedule. Relative to your taking back the secretary's job, I can only conclude that those golf matches are an irresistable lure. Still no golf for me—ski, tennis, volleyball, hike and climb.

"That *T.R.* issue also had the picture of **Pete Grant** riding on his ass. I haven't seen Pete since he joined the M.I.T. Alumni Office—the M.I.T. Club of New Hampshire meets way down in Nashua, or occasionally in Manchester, and it has proved impossible for me to make any of their meetings. So my main contact with Tech has been three kinds: 1) I continue on the Visiting Committee for the Chemistry Department; 2) I have been on the Alumni Advisory Committee to the Commission on M.I.T. Education; 3) I get to see some of my former friends and colleagues on the faculty whenever I can stop over in Building 6. Yet, despite these opportunities, I find I am slipping away from the intimate knowledge and contacts I once had of the place. There's no turning back, and indeed I have never regretted that the move to Dartmouth was right for me (and, I think, for M.I.T. too . . . a fresh challenge was a good thing.)

"Personally I have had lots of good things to enjoy. This past year, after several years of staying at home, I actually got to Europe twice: once in April for two short weeks in England, mainly at scientific meetings in Manchester, topped by a great long weekend climbing in North Wales; and then for five weeks in August and September, partly vacation (including 15 days in the Alps) and partly science again. A new wrinkle was playing some two-piano music at a conference in Leiden, some of the music being specially composed for the occasion by my Dutch scientific and musical friend, Ronald Koningsveld. Sylvia was with me on this latter trip.

"Our two boys are OK. Ralph is married and works for Mobil as manager of their Syracuse distribution terminal. His two-year old daughter, Kristin, is my sole grandchild to date. Hugh is single and at present working as reporter and cartoonist for a local paper in this region. Sylvia is extremely busy as Vermont State President of the League of Women Voters, now in her third and final year of it.

"Of our various national agonies and problems, what shall I write? I have no wisdom or insight. Many of us are seeing that what was once an adequate and even perhaps admirable way of operation is no longer considered enough, and indeed isn't enough to cope with the problems. Yet, although this is almost self-evident, it is so easy to slide daily into the comfort of the old routines and take refuge in the 'too busy' notion. The Commission on M.I.T. Education just has to come up with some new tricks to free M.I.T. for new efforts. I think they are a thoughtful and imaginative bunch who can do it.

"End of page looms. Best regards to all your family and to the '35 guys you see. I hated to miss our 35th, which in fact was the first reunion to which I couldn't go for at least a short time." As soon as Stocky takes up golf, I'll go up to try that Dartmouth College course I have heard so much about.

In spite of my love for mountains and skiing, my 16-year-old daughter, Pamela, is going to get to the Alps before her mother and I do. As you read this, she will be with her Newton High Ski Club spending 9 days at Chamonix. She spent a year working part time and baby-sitting to save the money for the trip.

Dick Bailey wrote from Kingsport, Tenn., in response to my letter telling him he had won the Class Golf Championship: "It was enjoyable hearing that I had finally won out over all those '35 tigers. All I had to do was to get my handicap up high enough. It finally got up to 9

where we are freezing them for the winter. I had some poor rounds in late August and September, but my swing got back on the track more often in October and I have been winning regularly of late. As a matter of fact, I won the Championship Flight Consolation the day before I heard from you. I couldn't use my handicap here and was crying loudly. But I played fairly well and won over two fellows. I hadn't beaten before. As for my family, we are all well, thank the Lord. Joanna, the eldest, has 3 children (oldest 12). Pat, next, is teaching grade school near you in Cambridge —single. Jerry with 3 children is in Atlanta. My youngest, Gary, 18, is still in high school. This makes for a lot of activities to keep up with besides my own, which are too many: School Board, City Park Committee, Legion Budget and other committees, Civitan Club, Country Club, etc. I'm about to be run out of town for suggesting we use some park land for school athletic and physical ed activities. My parents are well in South Yarmouth, sister (Mrs. Hal Crosbie) in Scituate (big in the herb business). And I'm still trying to make ends meet as Treasurer of ASG Industries, Inc.—a new name for the French name—now owned by U.S. interests." Thanks very much for writing, Dick, we're pleased to hear all about you and your family.

Our California correspondent, **Ham Dow,** writes from The Villages overlooking San Jose, as follows: "My golf has been good and bad during the last two months. Good enough to have won a low net flight in our G.E. office league season-end tourney (which I had suggested you join had you come); also to win my flight in the Villages men's championship. I was an also-ran in the Men's 1st Annual member-guest in which my boss was my partner. Before the date of the tourney he and his wife had purchased a villa here, so they are now neighbors. Ditto for me in the 2nd Annual mixed invitational which sound up with a gala dinner-dance. Edie's golf had improved to the low 60's for nine holes. But it is stopped by a tennis-elbow she developed from wacking the ground too hard. It's now improving, but she plans to rest it through the rains. . . . Perhaps you can time your visit next year for the second men's member-guest; I believe in June, but I'll check and let you know for sure. One possible hitch: Merri has no firm plan as yet, but mention was made of next June for her wedding. Locale not firm, possibly San Jose or Tucson. Her fiance will finish at Tucson this semester, then probably start a job elsewhere. Merri plans to finish in June at Tucson before the next step." If any of you get to the San Jose area you should swing up in the southeastern hills and see this delightful adult community of the Villages, complete with its own "everything." The Banquers, Dunns, Mowatts and Riches are among the '35 families who have visited. We are always glad to hear from you, Ham.

On a recent trip to Texas, I tried to reach **John M. Flaitz** at his home in Houston without success. Jack has been in Houston for many years, most recently as a consultant for the petroleum and natural gas industries. . . . A recent clipping from *Electronic News* tells us a little about **Howard Beck,** who started BTU Engineering 20 years ago: "Agreement in principle has been reached for acquisition of BTU Engineering Corp. by Corning Glass Co., Corning, N.Y. BTU manufactures high temperature electronic ceramic and metallurgical furnaces. Holders of BTU common stock would receive one share of Corning common for each 10 BTU shares. No additional details were disclosed, except that as a wholly owned Corning subsidiary, BTU would continue under present management, headed by J. Howard Beck, President." . . . The February, 1970 issue of *Detergents and Specialties* had the following brief about **John Demo** under a picture of John talking with the publisher. "Two years ago, John Demo, of CBX Enterprises, Inc. putting his nearly quarter-century experience on the line, wrote for *Detergent Age* a comprehensive article on the cosmetics and toiletries industry, outlining the potential benefits and existing hazards facing prospective entrants as well as those already in the business. The conclusion was that the high risks involved were in line with the high rewards attainable. Knowledge and experience in what appear on the surface to be deceptively simple fundamentals can greatly improve the odds in favor of success, Mr. Demo observed. In the article ("Potential Opportunities in Cosmetics and Toiletries," Jan. 1968) the industry's rapid growth was traced, some product categories and fundamentals explained, and the increasing role of Government agencies discussed. Mr. Demo also made some interesting projections on the industry's future. It was principally to check these projections two years later that we asked Mr. Demo to submit to an informal interview by *Detergents and Specialties* publisher, Ralph Dorland."

John lives at 76 Sparrowbush Rd., Upper Saddle River, N.J. In 1967 he left Avon Products after 16 years to set up a consulting business, CBX Enterprises. More recently he has formed John Demo & Associates for the purpose of furnishing broad advisory services to the industry. I hope when he sees this he will take a few minutes to write and tell us what he does in his spare time and bring us up-to-date with his family.

The latest batch of address changes tells us: **Jack Colby** is back in Islamorada, Fla., for the winter; **Jack Orchard** has moved to Rockville, Md., from Silver Spring, site of Helen's Half Acre (perhaps the grass was getting too hard to cut); **Robert Eastburn** has moved from Wilmington, Delaware to Avondale, Pa.

This is a reminder to those who haven't written to me. It's OK to do it now, or would Mrs. '35er write. Yes, and Miss '35er, too. What with women's lib and all, I think it's time we heard from our favorite co-ed to the West.—**Allan Q. Mowatt,** Secretary, 61 Beaumont Ave., Newtonville, Mass. 02160

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Plans for our 35th reunion are well in hand under the general chairmanship of **Henry McGrath. Leo Dashefsky** is deputy chairman and responsible for publicity. **Hal Miller** is in charge of program; **Frank Phillips,** finances; and **Fletcher Thornton,** activities. Your secretary will handle registration and hospitality. We will converge on Jug End in South Egremont in the Berkshires Friday evening, June 4, and adjourn to Cambridge after luncheon on Sunday. Dinner with dancing is planned for Saturday evening and a class breakfast on Sunday morning. Golf, tennis, riding, hiking and swimming will be available as well as conversation, conviviality, etc. I do hope you have made a note on your calendar and will try to join your classmates for this special weekend.

Al Bagnulo reports that he has taken a leave of absence from Pope, Evans and Robbins to fill the newly created post of Director of Pollution Control Plans and Programs for Fairfax County, La. His home address is 823 Empress Court, Alexandria (22308). Al is finding the task challenging but also frustrating. . . . In his position as Continuing Education Officer in the Continuing Engineering Education Program at George Washington University, **C. Donald Brown** is involved in short non-credit courses designed to provide the very latest information in the engineering, scientific, and engineering administration fields. . . . **Ed Halfmann,** Director of Research for the Philadelphia Electric Company is 1st vice president of the M.I.T. Club of Delaware Valley, Treasurer of the Philadelphia Section of I.E.E.E. and a member of numerous Research Committees and Task Forces for the Edison Electric Institute.

The Geological Survey of the U.S. Department of the Interior has announced the publication of a new map showing the distribution of molybdenum deposits. Although deposits are recorded in 29 states the largest are found in Colorado, New Mexico, Arizona, Nevada and Utah. The author of this map is **Robert King** of the Survey's Denver Office. Before joining the U.S.G.S. in 1948, he spent the years following graduation with Climax Molybdenum Company. He has made extensive studies and appraisals of mineral deposits throughout the western part of the country and is currently engaged in comprehensive research on the geology and geochemistry of molybdenum and rhenium. He is the Survey's commodity specialist for those metals.

Semon (Binkie) **Knudsen** has announced his entry into the growing field of luxury motor homes through Rectrans, Inc. Having spent four months on the campground circuit this past summer and having long had an intense interest in the variety of mobile living accommodations,

I shall examine this new one avidly when the opportunity arises.—**Alice H. Kimball,** Secretary, 100 Memorial Dr., Apt. 8-6C, Cambridge, Mass. 02142 or P.O. Box 31, West Hartland, Conn. 06091

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Bill Muckenhirn is chairman and professor of the Department of Electrical Engineering at the University of Toledo. Bill was nominated by the Toledo branch of I.E.E.E., and named Toledo Engineer of the year. . . . **Jim Newman** is vice chairman, Booz, Allen and Hamilton, and is also chairman of the board, Booz, Allen and Hamilton International N.V.. . . . **Les Klashman** was chairman of a U.S. water pollution control team which visited Japan to work with a Japanese team on mutual problems. He was hospitalized this summer with bacterial endocarditis and was finally discharged in July. . . . **Bill Bergen** has been promoted to group vice president, Aerospace and Systems, North American Rockwell Corp., El Segundo, Calif. He is also corporate vice president. Bill was formerly president, Space Division, NR, Downey, Calif.

Albert Hill is vice president-engineering and research, Martin Marietta Corporation.—**Robert H. Thorson,** Secretary, 506 Riverside Ave., Medford, Mass. 02155. **Curtis Powell,** Assistant Secretary, Room 5-325, M.I.T., Cambridge, Mass. 02142; **Jerome Salny,** Assistant Secretary, Egbert Hill, Morristown, N.J.

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You will recollect that in the last issue, I announced that I would send out postcards to those of you who changed addresses. If it weren't for those postcards, I wouldn't have much news to write about. A further note about those postcards: the more you put down, the more will go into print. Also, because of the time lag in going to press, do not feel that your reply has been ignored because several months have passed since you returned the card.

That takes care of the business this month. Now the news. **Johnny Summerfield** writes: "Since February, 1970, Staff Vice President—Economic Planning, Pan American World Airways. Anne and I will be living in Manhattan." . . . **Bernie Brod** writes: "President of Brod Sales Co., Inc., hobby is golf, and my team loyalties are with the New York Jets."

Johnny Toy writes that he has retired from Martin Marietta as plant engineer, and that his hobbies are all Florida sports. . . . A very interesting note from Dr. **Edgar B. Taft:** "I continue to be one of the staff pathologists at the Massachusetts General Hospital and an Associate Professor of Pathology at Harvard Medical School. In the last several years, however, I have been devoting most of my time to research administration as a professional associate of the Committee on Research at the MGH. We recently moved from Cambridge to Boston and now live adjacent to the Hospital." . . . **Jim Benson** reports: "Since retirement from the navy in 1957, I have been teaching math at Wentworth Institute in Boston." . . . Don Severance dropped me a line that **Lloyd Bergeson** addressed a seminar at M.I.T., "Special Management Challenges of the Shipbuilding Industry." Currently, Lloyd is general manager of the Quincy Division of General Dynamics." . . . We will close this month's notes with a pragmatic report from **Sam Steere:** "Enough of 'Bleeding Hearts'—let's get a pragmatic administration that will not allow itself to be victimized by irrelevant technicalities. First we must have a disciplined society or there is no freedom, only the law of the jungle."—**A. L. Bruneau, Jr.,** Secretary, Hurdman and Cranstoun, Penney & Co., 140 Broadway, New York, N.Y. 10005

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It is with deep regret that I must report the death of our president, **Bob Bittenbender,** on December 13, 1970; Bob had been ill for some time. Prior to being elected president in 1965, Bob was vice president from 1960 to 1965 and was reunion chairman in both 1950 and 1955. I have sent a letter to Sally on behalf of the class. For our 25th reunion of which Bob was chairman, he wrote: "After graduation I was converted from a civil engineer to an aeronautical engineer. Curtiss-Wright Corp., Buffalo, N.Y. employed me from 1940-45 designing airplanes. I left Curtiss to join Jackson & Moreland, Engrs., Boston, Mass., and was involved in projects ranging from power plants to nuclear reactors. I left Jackson & Moreland in 1950 to become chief mechanical engineer at Sylvania Electric Products, Inc., in Boston. I joined my present employer, Arthur D. Little, Inc., Cambridge, Mass., in 1951 and have been happily embroiled in the complexities of industrial research ever since, now being contracts manager for one of the divisions of the company. I married the former Sara (Sally) Southworth Cram of Waban, Mass., in 1940. She gets younger every year! We have two wonderful children, Sandra S. age 21 and Robert P. age 18. Sandy is a senior at Jackson College at Tufts University majoring in biology. She is a great swimmer and sailor. Our son Bob, is a senior at Lawrence Academy in Groton, Mass. He has turned out to be quite a cross-country runner, lacrosse player and sailor. I have been active in Alumni affairs and my good wife Sally has been the real worker behind the scenes in all our reunions. I find time to attend Alumni Council meetings and to participate in class activities. I am a Town Meeting Member in Lexington and a Vestryman and Chairman of the Episcopal Church Building Commission."

News this month is brief. We also have belated notice of the death of **Andre F. Leman,** Course IV, on August 8, 1969, but we do not have any other details.

Harold Graham sends a note that he has been in contract packaging for the last 14 years; five children, oldest two at Stanford University; active in American Youth Hostels, especially ghetto youth, also YMCA and Technion. He bicycles seven miles to work every day, and has just returned from a bicycle tour of Europe with the International Bicycle Touring Society; he worries a lot about population explosion and erosion of the environment. . . . **I. M. Pei** was honored by the International Institute of Boston at a banquet at Anthony's Pier Four on December 2, 1970; this was the first time that the Golden Door Award, established in 1964, was ever made in Boston. The award honors U.S. citizens of foreign birth who have made an important contribution to American life and culture. Dr. Pei has designed large scale urban developments, both public and private, in Cleveland, Philadelphia, Chicago, Los Angeles, Providence, New York and Boston. He designed Boston's new Government Center and also the Earth Science building at M.I.T., the Christian Science Center in Back Bay and the new John Hancock Tower under construction in Copley Square. He has been chosen to design the John F. Kennedy Memorial Library in Cambridge. . . . **Joe Greenberg** writes that the American Society for Metals honored 200 of their 40,000 members at a convocation on October 18, at Metals Park, Ohio, with the Fellow of the Society honor which was established to "provide recognition to members for distinguished contributions in the field of metals and materials." Joe writes, "I was privileged to receive this honor, with my citation reading as follows. 'For applying metallurgical engineering knowledge and experience to serving industry and the technical community both in this country and abroad.' Among others honored was classmate **Herb Holloman."** Please write your secretary.—**Alvin Guttag,** Cushman, Darby & Cushman, 730-15th St. N. W., Washington, D.C. 20005

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Your 30th reunion committee held its second and third meetings on November 23rd and January 25th respectively with class president, **Ed Marden** presiding. To provide ample meetings for ironing out problems and details in programs and accommodations and thereby insure maximum convenience and enjoyment of your reunion on June 4-7, 1971, at M.I.T., the reunion committee is scheduled to meet again on February 23, March 29, April 26 and May 31. These meetings begin at 4:30 p.m. at the Faculty Club on Memorial Drive in Cambridge. Of course all classmates are invited to attend and those in the area are expected to do so. **Leona Zarsky, John Sexton** and **Walt Kreske** are working out a "package" on lodging, meals and activities in coordination with **Reid Weedon**'s program plans for adults and children and **Fred Watriss**'s preliminary budget. One item definitely on the agenda is the Pops Concert scheduled for Sunday night, June 5, for which tickets have already been reserved. If you have not already received

a mailing with further details from **Irv Stein,** one will arrive shortly. Other 30th reunion committee members are: John Anderson, Mitchell Marcus, Edward Beaupre, Martin Ernst, George Hite, Michael Driscoll and Harvey Pofcher.

Robert W. Blake has been promoted to staff vice president-operations planning, at Pan American World Airways. In his new position he will be responsible for the coordination of all planning aspects of Pan Am's operations department, which includes 177 aircraft and some 25,000 personnel. His office is now in New York at John F. Kennedy International Airport. Bob was formerly Pan Am's resident representative at the Boeing Co. in Seattle, Wash., where on December 12, 1969, he signed acceptance papers for the "Clipper Young America", the first 747 delivered to Pan Am. Since that time he has accepted 23 other Pan Am 747's before departing for his new assignment in New York. As resident representative, he coordinated Pan Am's on-site aircraft development programs at Boeing, including 747 jet transports, and the supersonic transport. Bob, a native of Quantico, Va., joined Pan Am in 1941 as an apprentice engineer. He has held numerous assignments with Pan Am, including that of executive vice president of Ariana Afghan Airlines in Kabul, Afghanistan, a Pan Am affiliate, and resident representative at Avions Marcel Dassault in Bordeaux, France, the firm which manufactures the Fan Jet Falcon business jet. A former U.S. Navy pilot, Bob is married to the former Ruth Gafney of Rockville Centre and Brooklyn Heights, N.Y.

Martin L. Ernst is the author of the article "What Else Will Computers Do To Us" appearing in the October 21, 1970, issue of the *Wall Street Journal.* The article points up the growing negative social impact from increasing use and efficiency of computers which up to now has received only minor attention. He views the social impact as being classified into three broad areas: depersonalization, talent bias and user vulnerability. He points out that depersonalization results from the need for a high degree of standardization required to effect efficient computer use, thereby tending to antagonize people by making them feel molded to fit a computer's needs rather than the other way around.

Talent bias, he says, results from the increased emphasis on technical orientation needed for servicing the rapidly increasing numbers of computers as distinguished from humanities orientation. He claims this to be a talent bias which is resented among students in educational institutions as well as among employees in corporate organizations. User vulnerability, he points out, becomes increasingly important as reliance on computer output increases. He says that such vulnerability stems primarily from breakdown time for even small periods. For example, even a 5-minute breakdown in a stock market trading computer may be nearly disastrous. Martin is vice president and head of the management sciences division of Arthur D. Little, Inc.

Kenneth A. Bohr has returned to Washington, D.C. after 4 years in New Delhi, India, as deputy resident representative of the World Bank. He is now in charge of the industrialization division in the World Bank's economics department. . . . **Sterling H. Ivison, Jr.,** has retired from the navy as of January 1970, after 29 years active duty, mostly in industrial engineering and financial management positions. He is now working for his Ph.D. in business administration at The American University. . . . **Vaughan Morrill, Jr.,** is presently a consultant and independent inventor in the field of glass technology in which he holds several patents. —**Walter J. Kreske,** Secretary, 53 State St., Boston, Mass. 02109; **Everett R. Ackerson,** Assistant Secretary, 831 Cranford Ave.. Westfield, N.J.; **Michael Driscoll,** Assistant Secretary, 63 Center St., Nantucket, Mass.

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Captain **Bernie Moulton,** U.S.N., writes that after four years at the Pentagon, Janie and he have returned to Yokasaka, Japan, where he is commanding the Fleet Training Group, Western Pacific. . . . **Marty Levene** has been promoted to Associate Professor of Radiation Therapy at Harvard Medical School. Marty is also busily travelling about the United States as a member of the National Cancer Institute's Cancer Investigation Review Committee. . . . The governor of Florida has awarded a plaque and citation for conservation efforts to **Hilda Kressman.**

We have noted that **Bill Dennen** is Chairman of the geology department at the University of Kentucky and has recently been named Dean of the Graduate School and Acting Dean of Engineering. Bill, who was an undergraduate with our Class, received his Ph.D. in geology at Tech and is now starting a new doctoral program in the Department of Geology at the University of Kentucky. We wish him the best for continued success there. . . . **Fran Staszesky** addressed the Boston section of the A.S.M.E. on the subject, "Power Supply in New England." As executive vice president of the Boston Edison Company, Fran should have had a lot to say on this subject, but I wonder whether he was presenting the problems or the solutions! . . . **Bob Greenes** has been appointed chairman of the Fuel Oil Committee of the National Oil Jobbers Council. . . . **Lou Rosenblum** writes that Sandy is a Radcliffe Institute Scholar concentrating on performance problems of 19th Century piano music. She's also preparing an edition of keyboard music for teaching performance customs of various musical periods. Sure sounds like quite a switch from teaching music at Concord Academy.

The news is sure a little thin this month. How about one and all sending me a short letter, postcard, clipping or what have you, about almost anything.—**Ken Rosett,** Secretary, 191 Albemarle Rd., White Plains, N.Y. 10605

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The report for the Class of 1944 will be very short this month: not too many notes and I am very busy at the office writing a proposal (those of you in the aerospace business will understand the importance of that these days). **Lou Roddis,** the President of Consolidated Edison of New York, was a key panelist at a meeting of the American Nuclear Society in November. Spokesmen from the Atomic Energy Commission, electric utilities, designers, architects and engineers reviewed the problems of nuclear standards. The announcement noted that Lou is a "seasoned utility executive with experience in all aspects of utility management and operations. He is a member of the National Academy of Engineering, a past president and director of the Atomic Industrial Forum, and a past president and director of the American Nuclear Society. He participated in early Navy nuclear projects and was later the deputy director of the A.E.C.'s Division of Reactor Development." . . . **Lamar Field** dropped us a note via his contribution to the M.I.T. Alumni Fund. "Keep busy trying to write-up our research on biochemically related organic sulfur chemistry and on reviews I get myself committed to do (one down and two to go). Was elected secretary of the Graduate Faculty Council and Graduate Faculty at Vanderbilt—am finding that the minutes take hours." I can vouch for that Lamar.

Francis K. Davis, Jr., noted that he had been appointed dean of the College of Science at Drexel University in July 1970. . . . **William C. Cooley** writes, "My company, Terraspace Inc., is designing a water cannon under contract to the Department of Transportation. It will be used for tunneling experiments and will produce pulsed jets of water at pressures of 300,000 to one million psi." I heard Bill speak about this work at a transportation meeting where he indicated the potential of such a technique compared to mechanical drilling. He showed interesting pictures of Russian tunneling equipment.—**John G. Barmby,** I.I.T. Research Institute, 1825 K St. NW, Washington, D.C. 20006. Call me on 296-1610 if you visit Washington.

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There are less than four months remaining before our 25th reunion on June 4-7, 1971. I hope you are making your plans to attend what will be an important, rewarding and enjoyable event.

A fine letter from **Ernest U. Buckman** provides a good deal of information on Ernie's activities these past 25 years. After graduation in February, 1946, Ernie served aboard the cruiser U.S.S. *Montpelier* until his release from active duty

in July, 1946. He was recalled in January, 1951, and served aboard destroyers in the Atlantic and Mediterranean fleets until December, 1952, when he was released to inactive duty as a lieutenant (U.S.N.R.). Ernie married Katherine Stearns in 1946 and they have three children. The eldest daughter, Margaret, graduated from Sarah Lawrence College and was recently married to O. G. Holdring of Minneapolis. The second daughter, Elizabeth, attended the Maderia School in Virginia and the third child, John, has been attending the Sewickley Academy near Pittsburgh. Ernie and his family live in Sewickley, a Pittsburgh suburb. Ernie is president of Oliver Realty, Inc., a division of the Oliver Tyrone Corp., at 3500 One Oliver Plaza, Pittsburgh. Oliver Realty is engaged in real estate leasing and management. Ernie has been active in several nonbusiness endeavors, his favorite being Junior Achievement. He is now president of Junior Achievement in the Pittsburgh area. He was director and now is vice president of Vocational Rehabilitation Center, Chairman of Agency Properties Committee of the Community Chest. He has also been active as Deacon of the Presbyterian Church of Sewickley, director and secretary, Sales-Marketing Executives of Pittsburgh and an educational counselor for M.I.T. After serving eight years as committeeman for the Republican Party in Pennsylvania, Ernie ran as an alternate delegate for the National Convention held in 1968 in Miami. Ernie won and went to the convention in Miami and participated in all the activities, noise and excitement, and nominations we all witnessed on television.

David M. Denzer has replied to a recent mailing we made and we do appreciate Dave's fine response. Dave remembers back to the talk at M.I.T. on preparation for marriage by F. Alexander Magoun. Dave recalls he said we would have two important choices, the spouse and the job. Dave has selected well in each case. He met Ann Haft in the summer of 1950 and they were married the following spring. The Denzers have two children, Richard, 14, and Jacqueline, 9. They live at 2223 Grand Blvd., in Schenectady, N.Y. Dave joined G.E. in Schenectady in 1953 and has found the answer to the question he wondered about when at M.I.T. Namely, what it is that is done 8 hours a day for years and years by an engineer. Dave has recently joined the joggers and avidly urged the rest of us to adopt adequate exercise for it does make you feel better.

Barbara G. Bowen has sent in a short note which I wish were longer and more informative. It says that after several years of working overseas in the near east, Africa, and Europe, Barbara is enrolled at Teachers College, Columbia University. She is working for a master's degree in adult education and is expecting to complete her work for this degree in June, 1971.

That's all—so please write us of your activities.—**Russ Dostal,** Secretary, 18837 Palm Circle, Cleveland, Ohio 44126

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The holiday mail situation requires that these notes be written early so I had better take a respite from the frustrations of trying to install a door closer and proceed with this task. Gina always says that M.I.T. should have classes in home repair. She is probably right and if such courses were compulsory we might all be apartment dwellers.

My filing system also broke down so the following communiques are being passed on a bit late. **Vern Sholund** is senior mathematician for Jet Propulsion Laboratory in Pasadena, Calif. In this capacity he is working on a lunar electromagnetic sounder for the Apollo 19 and possibly 20 and could get into tests in the general theory of relativity. . . . **Eugene Wejman** is with the Oxford Pickle Co. and has received an Ecology Citation from Governor Sargent for work done in the area of water pollution. He has also been elected to a three-year term as the Director of Pickle Packers International. . . . **Joe Childs** is manager of field product development for Foxboro. He is a director of the Foxboro Red Cross and, having four sons ages 10 to 14, is active in scouting and little league. . . . **Carl Eyman,** whom I haven't seen since our 20th, writes to say he has been transferred from Thibudoux, La., to Fewankee, Wisc. He is still a candy maker and will be vice president in charge of production at the Howard B. Stark plant. Carl received his M.B.A. from Nicholls State in Thibudoux and older son Carl III received his B.S. as a physicist. Carl's son is going for his masters and working for Gulf South Research in New Orleans.

Will Freyberger who has his doctorate has recently been appointed director of the Institute of Mineral Research at Michigan Tech. . . . **Stan Landgraf** is president of the M.I.T. Club of St. Louis and earns his living as chief project technical engineer at McDonnell Aircraft. He advises that his main concern is with advanced engineering studies in VTOL aircraft. . . . **James Van Meter** writes that he has been with Honeywell for 10 years in Minneapolis and now 5 years in Arlington, Va. He is manager of Air Warfare Technology Requirements in the Military and Space Sciences Department. This is the R and D planning staff for Honeywell's aerospace and defense group. His wife Ruth and he have three children Nancy 12, David 10 and Charles 7.

On the moving front the trend seems East as I note the following: Gene Gettel from Phoenix to Andover, Mass; Dick Hyde from Denver to Morristown, N.J.; Walt Kisluk to Williamstown, Mass; Bill Latady to Hingham; Bob Clement with Shell from Emeryville to Houston and going counter is Al Black from Massachusetts to Santa Barbara, Calif.

Now to take my door closer to the hardware. Make a plan to write in 1971.—**Dick O'Donnell,** Secretary, 28516 Lincoln Rd., Bay Village, Ohio 44140

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We have all come to that part of the year when we take down the old calendar and put up the new, and make resolutions that usually never last. Personally, I wish every one in the Class of 1948 a happy and prosperous new year.

A news release was received on **Roland L. Nagy,** Course X, who has been named manager of the newly-created commercial development department of the process plants division of Foster Wheeler Corporation. As manager, Roland will be responsible for the acquisition of processes and technologies new to the Corporation. . . . **Robert L. Stern,** Course X, has been named manager of advanced technology services on the research and development staff of Xerox Corporation. Bob will be concerned with relationships of the Xerox research and development staff to the academic, governmental, industrial and professional communities. Best of luck to you. . . . I received notes recently from the following classmates. **Ernie Miklau,** Course II, writes that he has finally settled down in the research department at Mack Trucks, Inc., in Hagerstown, Md. . . . **Edward G. Sidd,** Course XX-A, is now associated with Crompton & Knowles Corporation as manager of marketing development for the food, drug, and cosmetic materials department.

Gordon H. Pettengill, Course VIII, recently accepted an appointment as Professor of Planetary Physics at M.I.T. Gordon has come full circle from his undergraduate days. . . . **Perry L. Nies** has moved from Massachusetts to Florida to become executive vice president of Fourdee, a small fifty-person electronics manufacturer. Perry is looking for suitable new products and company affiliations for high volume proprietary manufacture. . . . Unfortunately, **Ronald J. R. Kallman,** Course VIII, took an unscheduled trip to Havana aboard TWA 54. Ron does not recommend either the cuisine or the service in Cuba.

After receiving his M.Ed. degree in general engineering from Pennsylvania State—under an N.S.F. grant upon retirement from the U.S. Army as a Lieutenant Colonel in 1967——**Fiorenzo D. Losco,** Course IX-B, has been teaching math at Atlantic Community College. . . . **William M. Ihde,** Course VI-A, has been establishing an acoustic consulting firm and an instrumentation rental firm. Bill started his own business in 1969 after working for General Radio Company for 21 years. . . . **G. Fred Dunmire,** Course XVI, is currently working as director of operations and plans at Grumman Aerospace Corporation. . . . **Joseph V. Yance,** Course XV, lectures in economics at Boston University and has been analyzing the possible use of pricing (of landings and takeoffs) to reduce airport congestion. Joe is a consultant

for the U.S. Department of Transportation. . . . **Vincent E. Lally,** Courses VI and XV, of the National Center for Atmospheric Research urges the weather services to ban all radiosonde flights over the continental United States above 30,000 feet. The impact of one of these balloon-borne instrument packages with a jet airliner flying at 550 knots could shatter the windshield. Vince suggests the ban as a U.S. Weather Services centennial birthday present to aviation.

Paul W. Barcus, Course VI, has been selected to appear in the 1970 edition of *Outstanding Educators of America.* Paul is an associate professor of nuclear engineering at Iowa State University.

Included in this news received some time ago is about **Robert H. Quint,** Course VI. Bob is with American Cystoscope, and is concerned with the development of many devices of an optical and electrical nature for use in clinical and medical research facilities. Most recently, he has been involved in the marketing of new optical instruments and electrosurgical devices. Bob is also a member of the Optical Society of America. . . . A fortune in building the long, hard way describes **C. Vincent Vappi,** Course XVII, a 42-year-old urban builder from Boston. An article in *U.S. News and World Report* in December, 1969, described Vince's success. Vappi and Company has grown steadily and his personal fortune, now more than 2 million dollars, has risen accordingly. Vin's father started the business in 1927 building a few warehouses. Upon graduation from M.I.T., Vince joined as a field supervisor at $90 a week, and in 1955 started to make changes. He states, "The key events were getting the next big job to show we could handle bigger or more complex buildings, or do big jobs in a hurry." . . . "Money isn't the big thing with Vince. He gets a sense of accomplishment, going around Boston and seeing the buildings he has put up, buildings that will be around after he has gone."—**S. Martin Billett,** Secretary, 16 Greenwood Ave., Barrington, R. I. 02806

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As I write these Notes it is early December and winter has just emerged. The sub-freezing weather feels bitter cold. To make matters even worse, the two Alumni Fund notes this month come from warmer climes. **Jerry Leva** writes: "Educational Council—Gunn High School, Palo Alto, Calif. Sent two coeds to M.I.T.'s class of '74 this year." The second note sent me to the 1967 M.I.T. Alumni Register to confirm that **Robert C. Peterson** is working in Abadan, Iran. He writes: "Bob Peterson represented M.I.T. at a 'college night' sponsored by the local chapter of The National Honor Society. The representatives of some 30 colleges met Juniors and Seniors of the Tehran American High School and the Community School and answered questions about life at their alma mater."

From M.I.T. comes word that **Gaetano Falabella, Jr.,** deputy director of the Airdrop Engineering Laboratory, U.S. Army Natick Laboratories, is one of four M.I.T. alumni who are among the 26 Fellows of the Practicing Engineer Advanced Study Program for 1970-71 at the M.I.T. Center for Advanced Engineering Study. The program is designed to permit those selected to work with a senior faculty advisor on a course of study which usually covers two semesters. The intent is to help people with senior technical responsibilities and a major role in generating new technology within their organizations to be up-to-date and informed about current technology.

Finally, the Buckeye Pipe Line Company announces that **Donald Merriman** has been elected president. The Buckeye Pipe Line Company operates one of the largest petroleum pipe line systems in the country. In 1969 they had revenues of $37.6 million and pre-tax profits of $12.2 million. Buckeye has headquarters in New York and Macungie, Pennsylvania and is a wholly-owned subsidiary of the Pennsylvania Company. Don Merriman joined the Buckeye engineering department in 1949 following his graduation in mechanical engineering. He was named vice president of operations in 1963 and executive vice president in 1969. He lives in Huntington, Long Island.

Shortly after you receive this issue I will be basking in the sun in St. Croix if current plans materialize. Writing this column has the pleasant side effect of making that day seem nearer. Best wishes to all.—**Frank T. Hulswit,** Secretary, 77 Temple Rd., Concord, Mass. 01742

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August P. Doering is now research manager of Azoplate Corporation in Murray Hill, N.J. . . . **Leonard M. Smith** is vice president and treasurer of Cognitronics Corporation and keeps himself busy by chasing 5 children, caring for 2 gordon setters (one of whom he field trials), and trying to sail his 22-foot sailboat in handicap races. . . . **James J. Staikos** is presently a resident of Athens. . . . **David E. Webster** has recently moved to Berwyn, Pa., from Tampa, Fla. He is group vice president of Safeguard Industries, a rapidly growing diversified company consisting of more than 30 operating companies.

Paul M. Zorn, Jr., reports that he has been a high school chemistry/physics teacher and department chairman for the past 10 years and has been enjoying it very much. . . . **Paul Slepian** tells us of his two new positions: 1969-70 as Chairman of the Department of Mathematics, Bucknell University, Lewisburg, Pa.; and 1970 as Professor of Mathematics, Howard University, Washington, D.C. . . . **David B. McLeod,** of Albany, N.Y., has been elected president of International Wagenknecht, a manufacturing firm. The firm is a division of Albany International Corporation of Albany, N.Y. Mr. McLeod has been with the company for 20 years, serving as production manager and plant manager.

Professor **Robert W. Mann** of the Department of Mechanical Engineering has been appointed the Germeshausen Professor commencing with this academic year. The Germeshausen Professorship, established in 1968 by Mr. and Mrs. Kenneth J. Germeshausen is intended to support M.I.T.'s strong interests in combining humanitarian advances with technological progress. Professor Mann is a leader in increasingly successful efforts to apply modern technology to helping the blind, deaf and physically handicapped. He was one of the principal developers of the Boston Arm, a cybernetic prosthesis for persons with above-elbow amputations, and, as founder of the M.I.T. Center for Sensory Aids Evaluation and Development and chairman of its Steering Committee from its inception, he has had an important role in developing such aids as high-speed, electronic braille-embossing computer terminals; computer programs for braille translation; and mobility, recreational and vocational devices for the blind and deaf-blind. He is president of the Catholic Guild for All the Blind, Inc.

Andrew C. Price, Manager-Distribution and National Service Department, Business Products Group, Xerox Corporation, Rochester, N.Y., has been elected president of the National Council of Physical Distribution Management. He is married to the former Marilyn Secor and they have four children, two boys and two girls. The Prices reside in Penfield, N.Y.

John T. McKenna, Jr., of Bedford has been elected assistant vice president of Boston Gas Company. Joining Boston Gas in 1950, Mr. McKenna has held a variety of positions in engineering, gas production and customer service. He became manager of engineering in 1969. Mr. McKenna is chairman of the American Gas Association's Liquefied Natural Gas Committee and past chairman of the customer service managers' group of the New England Gas Association. Mr. McKenna and his wife, Dorothy, reside in Bedford with their four children.

Dr. **John H. Litchfield** has been named manager of the newly constituted Biology and Medical Science Section at the Columbus Laboratories of Battelle Memorial Institute. Dr. Litchfield will devote much of his effort to matching the capabilities of the Section's various research components with the needs of industry and government. Dr. Litchfield has been a member of the Battelle-Columbus staff since 1960.

John Kern and his wife joined families of the heads of the physics, classical studies and arts departments at Elmhurst College on a study/tour of the famous archeological sites in Greece and its islands this past summer. He says it is a long overdue sequel to Karl Deutsch's two terms on Plato!—**John T. McKenna, Jr.,** Secretary, 2 Francis Kelly Rd., Bedford, Mass. 01730

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Bill Benfer and Nancy and children, Sherry (17), Patti (15), and Paul (10) are now in Sherman, Texas where he is plant manager for the Government Products Division Operations in the Texas Instruments' Sherman plant. . . . **Claude** (Bill) **Coward** is now assistant chief, Hull Technical Dept., Newport News Shipbuilding and Drydock Company. He and Audrey have two daughters; Anne (13), and Mary (8). . . . **Salvatore DiMilla** is project engineer, Engine Design Group, Light and Medium Duty Trucks for International Harvester Motor Truck Division in Ft. Wayne and reports that he tries to get to Boston once a year and that he is still a faithful Red Sox and Bruins fan. He said that **Ted Trimble** is still with Ford and that Ted and Vera have four children ages 11-19. . . . **Paul Gibson** reports that he moved from Pittsburgh to Seattle three years ago. When not skiing with his wife, Priscilla, and their two teenage sons in the winter or sailplane flying in the summer, he can be found at Boeing where he is manager of environmental planning.

Chuck Hieken has opened his own law office in Waltham, Mass., after having served as a partner with a larger firm of patent attorneys. He and Donna have two children, Tina (7) and Seth (4).

Robert Johnson, Mary Ellen and children Cynthia (15) and David (4) have moved to Phoenix, Ariz., where he is engineer and estimator for Speros Construction Company. . . . **Lawrence Kuszmaul Jr.,** Harriett and Ellie (12) are back in Columbia, Md., where he is estimating heavy construction at the home office of Arundel Corp. Larry recently completed field work in Alabama on Holt Lock and Dam in Tuscaloosa, and on Claiborne (Ala.) Lock and Dam. . . . **Richard Lock** has been promoted by General Electric from project engineer, microwave tube operations, to electronic systems engineer in the clinical equipment section of the G.E. Medical Development Operation in Schenectady. He is living in Albany with his wife Nancy and children Thomas (16) and Laurie (15). . . . **Saul Neidleman** has been with Squibb Institute for Medical Research in New Brunswick, N.J., since receiving his Ph.D. in biochemistry from the University of Arizona. He is presently section head of microbial biochemistry in the Microbiology Department. . . . **Peter Ney** is now Professor of mathematics at the University of Wisconsin in Madison.

Willard Prince is the assistant director of planning and development at the University of Massachusetts, Boston campus and is involved in the development of the Columbia Point (Mass.) campus site for 15,000 students by 1980. The initial part of the project for 5,000 students is scheduled to be operational by 1972.

Howard E. Simmons has been appointed to a five-year term on the editorial advisory board of the American Chemical Society *Journal of Organic Chemistry.* He was recently promoted by E. I. duPont de Nemours to associate director for research in the Wilmington, Delaware Central Research Department.

Frank A. Stefansson has returned from Iceland and is now chief engineer at Bird-Johnson Co. in Walpole, Mass. He and Anna have three children: Rosa (17) Hilmar (15) and Frank Jr. (12). . . . Any of you classmates thinking of a vacation home in the Virgin Islands should contact **Daniel Sullivan** who has just opened an office there for practicing architecture of resort structures and homes. This is in addition to his winter office in Greenwich, Conn., and a summer office in North Eastham, Cape Cod. And speaking of the Cape. . . . don't forget: This is our 20th reunion year—meet us at the Provincetown Inn. . . . **Dick Warfield** is setting an example to make us envious, having retired early from Shell Oil Co., where he was associated with the geophysical exploration team. He is now overseeing the completion of construction of a small villa overlooking the beautiful bay of Acapulco and enjoying the good life with good wife Betty and children Stephanie (17) Richard (16) and Vicki (14) (all presumably good).

John Washburn Jr. reported that he and Dick Lemmerman '50 were again planning to enter the Bermuda race on a Cat 40 named Decibel. He and Barbara live in West Hartford with their two children Jay (11) and Sarah (9). . . . **Art Wasserman** writes that **Warren Rowland** left Allis-Chalmers and is now with Babcock and Wilcox in Beaver Falls, Pa. Art is director of engineering in the Allis-Chalmers R & D Division, and to make sure he didn't have too much spare time, he has spent the last two years, one day a week going to the University of Chicago on an executive program similar to the M.I.T. Sloan Fellow program. . . . **Walter Wells** still serves as a group leader in the M.I.T. Lincoln Laboratory and recently served on the M.I.T. study of air traffic control. . . . **Doris Wilson** reports from Wellesley that she is a chemist with Arthur D. Little.—Notes this month by **Paul Smith,** Assistant Secretary, 11 Old Farm Road, North Caldwell, N.J. 07006; **Howard L. Levingston,** Secretary, 358 Emerson Rd., Lexington, Mass. 02173; and Assistant Secretaries: **Marshall Alper,** 1130 Coronet Ave., Pasadena, Calif. 91107; **Walter Davis,** 346 Forest Ave., Brockton, Mass. 02402

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The members of our class in the military services are continuously on the move. Lieutenant Colonel **Daniel L. Lycan** writes that he is now a member of the class of 1971 at the U.S. Army War College, Carlisle Barracks, Pa. His wife, Alice (Finan), became the mother of a new son, John, last February. The Lycans now have five children. Dan says "If any of you are on the ski slopes in central Pennsylvania this winter, stop in and see us at quarters #591." . . . **R. C. Wingerson** writes that he now holds the rank of Colonel U.S.A.F. and is assigned as Deputy Director A. F. Systems Command, West Coast Study Facility and that he is enjoying life in Los Angeles.

There are quite a few of the class outside of the military services who do get around the world. A note from **David W. Ulrich** says that he and his wife, Barbara, are pleased to announce the birth of their third child, Geoffrey Bennett, on July 9, 1970. David and his family are all well and are enjoying their current assignment at the Amuay Refinery in Venezuela.

Alexandre Maidanatz is now back in the Paris headquarters of Telemecanique after assignments in Belgium, the U.S. and Canada. Alexandre is manager of the Pilot Devices Department of the Electric Motor Control Division of Telemecanique. His responsibility covers development, production marketing and profit and loss of the Pilot Devices line. . . . From **George W. Stetson, 3d,** comes a note saying that he has recently spent another year at Montego Bay, Jamaica, W. Indies, doing free lance engineering of total energy systems. George is now involved in measurement systems for compressor development at N.R.E.C., Cambridge, Mass., and would enjoy hearing from any classmates in the local area. He is now living in Hingham, Mass., at 10 Parker Drive.

Two notes have arrived from classmates in the field of medicine. **Gilbert B. Solitare** writes that he is now chief, section of forensic pathology, Yale University School of Medicine. . . . **Leonard Schwartz** is presently practicing internal medicine and allergy in Encino, Calif.

Among the classmates who are professors are Dr. **Ernest Capstack** who is presently professor and chairman of the Chemistry Department at West Virginia Wesleyan College and **Rudolph Preisendorfer,** who is professor of a Naval Post Graduate School at the Naval Post Graduate School, Monterey, Calif. Professor Preisendorfer recently presented a paper, "A General Theory of Radiative Transfer across the Random Atmosphere-Ocean Interface," at the 3rd Atlas Symposium on Transport Theory held in Oxford, England, in September, 1970.

Several fairly old news clippings have come to my attention regarding activities of members of the class. A clipping dated February, 1970, indicates that **Bradford H. Schofield** of 27 Cedar Rd., Belmont, Mass. was awarded the degree of Juris Doctor at the mid-year commencement exercises of Suffolk University. Bradford is an engineering manager with Teledyne Materials Research in Waltham, Mass. He is a member of the American Society of Mechanical Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Metals, the Society of Experimental Stress Analysis and the American Bar Association. He is married to the former Sally A. Lopez of Watertown and is the father of four children. . . . In June, 1970 **Leonard Nanis** was a co-recipient of the 1970 Richard L. Templin Award of the Ameri-

can Society for Testing and Materials. The award, given for an outstanding paper describing new and useful testing procedures and mechanical apparatus, was presented at a luncheon in Toronto, Canada. . . . In late June this year, **Sanford R. Greenfield,** an architect in Boston for 12 years, was elected to the College of Fellows of The American Institute of Architects, a life-time honor bestowed for outstanding contribution. Sanford was formally invested during special ceremonies at the annual convention of the A.I.A. in Boston. Although the A.I.A. is the 23,300-member national professional society of architects, only 957 members have been advanced to Fellowship. Sanford is a partner of the firm Carroll and Greenfield, whose major projects include St. John's Seminary Library, Brighton; Young Israel of Brookline, and the new Airport, Orient Heights and Maverick stations in the MBTA's modernization plan. He and his family reside at 2 Mason Terrace in Brookline.

Charles M. Saltsman writes that he was recently promoted from manager, ordnance engineering department to vice president, Raymond Engineering Inc. He was also appointed member of the Educational Council of 1970. . . . **Dudley B. Hartung** was recently elected to the board of Xenex Corp., Waltham, Mass.

R.C.A. has announced the appointment of **Laurence E. Golden** as manager, atmosphere explorer project, at the R.C.A. Astro-Electronics Division, Princeton, N.J. Prior to his promotion, Mr. Golden had been manager, spacecraft preliminary design, and in this capacity directed a group of engineers working on spacecraft systems studies and design concepts. Also at R.C.A., he had been manager of the SERT 1 Project, a spacecraft that successfully tested ion engines in space. Prior to his affiliation with R.C.A., he had been affiliated with Allied Research Associates as an assistant project manager. He is also treasurer of the Princeton Section of the American Institute of Astronautics and Aeronautics and serves on the Education Committee of Temple Ashe Emeth of New Brunswick, N.J. Laurence, his wife, Joan, and three children reside in Edison, N.J. . . . M.I.T. has recently announced the appointment of **John E. Jordan** as administrative officer in the Department of Chemistry.

Bill Chandler writes that he is presently manager of Real Estate Coordination and Planning for BP Oil Corp., a subsidiary of Sohio. He is now living at 965 Winding Creek Trail, Atlanta, Ga. 30328. His family includes a daughter, Lisa, 16, a junior at North Springs High in Sandy Springs, Ga.; and a son, Jim, 13, in the 8th grade. . . . **Leith Holloway** writes that he is enjoying living in Princeton, N.J. because the surrounding area is rural enough so that he can own and use a bicycle for riding to the office occasionally and around the countryside. He says that he has not cycled as much since his days at M.I.T. Your Secretary has finally found a rural route to work also and has been discovering that cycling to work does wonders for the constitution. . . . **Brenton R. Groves** recently presented a paper on navigational training at the 25th Annual Meeting of the Institute of Navigation, U.S.A.F., Academy, Colorado Springs, Colo. . . . **Donald C. Gillam** was recently a co-author of an article appearing in the *Honeywell Computer Journal,* "Making Peripherals More Reliable." Donald has been a design engineer with the consulting firm of Graydon Smith & Co., where he worked on a wide variety of projects including the design of a "coffeegrinder" winch used on the America's Cup winning yacht Constellation, and he was also manager of Systems Engineering at Marken Corp., manufacturers of industrial mailing equipment. He joined Honeywell in the fall of 1969. Outside of work, he has been active in various community affairs including the formation of a Lions Club, of which he was charter president. He lives presently in the Nashua, N.H. area and is very active in the New Hampshire Lions organization as a deputy district governor.

And surprisingly, one of our class is back in school at M.I.T. **Melvin M. Cerier,** technical manager of the Communications Systems Division, Sylvania Electric Products, in Needham, Mass., is a 1970-71 Fellow of the Practicing Engineer Advanced Study Program at the M.I.T Center for Advanced Engineering Study. The Practicing Engineer Program is one of several activities conducted by the center to help engineers and scientists deal with new and rapidly advancing technology. Companies and organizations nominate key men for the program at M.I.T. Those selected usually spend two semesters at the Institute. During the 1970-71 academic year, 26 engineers and applied scientists from industry and government will be enrolled in the program. —**Arthur S. Turner,** Secretary, Lowell St., Carlisle, Mass. 01741

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The amount of class news seems to be related to the length of day; if you would turn on the lights and jot a note about your latest machinations, perhaps spring would come. . . . **Charles Ladd** was recently promoted to Professor of Civil Engineering at M.I.T. He is chairman of the Department Committee on Graduate Students, and head of the Geotechnical Section of the Boston Society of Civil Engineers. . . . **George McCanless** sent me a note with two interesting papers on some recent work of his at Chrysler Corp. in Huntsville, Ala. Under a NASA-supported study, George developed a method of computing aerodynamic forces on flexible launch vehicles and missiles in supersonic flight. The results were reported in the September 1970 issue of the *Journal of Spacecraft and Rockets.* In another paper in the September 1970 issue of *Automotive Engineering,* George described the design of hood scoops for racing cars and showed how the results of aeronautics research can be applied to increasing auto performance.

Among those who have changed employment are **John M. Stem,** who is now with Gates Rubber Co. in Denver, Ohio, and **John A. Welsh,** who is now at Southern Methodist University, Dallas, Texas. Both were formerly with Flow Labs, Inc. in Rockville, Md. . . . A recent news clipping describes the new responsibilities of Col. **Leonard R. Sugerman,** who has been named assistant AF deputy and chief of the AF Range Operations Office at White Sands Missile Range. This new office is a staff agency of the AF Special Weapons Center, and its purpose is to sponsor AF programs on the range and to provide support for national range activities. Last fall Col. Sugarman was awarded a Certificate of Appreciation by the M.I.T. Alumni Fund for his outstanding work as the Almogordo regional chairman.— **Allan C. Schell,** Secretary, 19 Wedgemere Ave., Winchester, Mass. 01890

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Pardon me if you have heard this before, but remember June 4 to 6 is the date of our 15th reunion at the Harbor View on Martha's Vineyard. Contact **Bill Grinker** or one of the vast multitude on the reunion committee. . . . **Avraham Berkovits** is spending a year in Fatigue Research at NASA, Lewis Research Center. Avraham and family are in the U.S. on a year's leave from the Israel Institute of Technology. . . . **Howard Bertan** has formed Bertan Associates to manufacture precision solid state power supplies for CRT displays and nuclear instrumentation.

Phil Bryden and family are back in Waterloo, Ontario, after a year at the psychology department of M.I.T. On August 19, 1970, a second daughter, Pamela, joined the family. . . . **Curt Burrowes** is still offering industrial production and marketing research via Burrowes Research while his wife, Kathy, produced their third child at the end of November. **Jacob Gubbay** writes that he was married in June 1970. Spurred on by this, now he is manager of the Materials Center of Honeywell EDP, has recently received a patent, and is giving a talk on managing the rising costs of materials at a symposium of the American Society for Metals.

Larry Moss has been the author of some of the studies on the engine noise problems that the SST would cause in the areas surrounding major airports. . . . **Max Plager** writes that he bought a new townhouse on South Michigan Avenue in Chicago in 1968, then acquired a sheep dog in 1969. Wife Shelly received her master's in mathematics in 1969, then retired to await the arrival of Charles Louis Plager in June 1970. Meanwhile Max continues to teach computer programming and mathematics at the university there. . . . **Jesse Rothstein** is still practicing patent law at Amster and Rothstein in New York. . . . Dr. **Robert Sawyer,** Lieutenant Commander U.S.N., has been elected a member of the Undersea Medi-

cal Society. Bob is stationed at the submarine base in New London. . . . **John Seeger** left M.I.T.'s Division of Sponsored Research last April to become administrative officer of Jay Forrester's research group on the dynamics of social systems. Currently working on feedback analysis in the processes of building slums (Urban Dynamics) and of World Ecological Cataclysm.—Cosecretaries: **Bruce B. Bredehoft,** 3 Knollwood Dr., Dover, Mass. 02030; **T. Guy Spencer, Jr.,** 73 Church St., Weston, Mass. 02193

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In October Betty and I visited Boston and had the pleasure of seeing many of our classmates and their spouses at a cocktail party organized on short notice by **Arthur Aznavorian.** The photos appearing with this column tell the whole story—a very trendy group indeed. Among those present were Judy and **Jack Currie,** Allegra and **Doug McIver,** Marge and **Bill Doughty,** Susan and **Arthur Aznavorian,** Ann and **Bill Brandon,** Jane and **John McAllister,** Jill and **Mal Jones** and Barbara and **Hugo Liepmann.** One of the major items of discussions was the reunion in 1972. I hope to begin reports on the preparations in a few months. . . . Doug McIver, I learned, was elected a **George F. Baker** scholar at the Harvard Business School. This honor is bestowed upon those who are within the top five per cent academically at the end of their first year. After a stint in the Army, Doug joined Sperry Gyroscope as an engineer. Then from 1964 until entering the Harvard Business School he was a project engineer with the Navy Strategic Systems Project Office in Washington.

Our classmates who received citations for their work on M.I.T.'s seminars for young alumni were **Ed Roberts, Don Shreffler, Don Roelke, Bill Salmon, Stanley Kroder, John Roberts** and **Frank Sellars.** Others received citations for their work on the 1970 Alumni Fund, namely: **Alan May, Martha Goodway** and **Bob Batchelder.**

Members of the Class of '57 gathered recently for an "on-short-notice" cocktail party: Marge and Bill Doughty (upper left photo); Mal Jones (left) chatting with John McAllister—Jill Jones (foreground) upper right photo; Jack Currie, Barbara Lipmann, Hugo Lipmann and Judy Currie—from left to right (lower left photo); and on the lower right (from left to right) more smiling faces—Bill Brandon, Allegra and Doug McIver and Ann Brandon.

In *Nation's Business,* under the headline "Dynamic Growth Companies: 1" appeared recently an article on Koch Industries, Inc. I quote in full: "The taut reins of one of the nation's largest—but least-known—privately-owned firms are held by **Charles D. Koch,** 34, with help from his 29-year-old twin brothers. Headquartered in Wichita, Kans., Koch (pronounced 'coke') Industries, Inc., is a diversified world-wide business. It is in all phases of the oil business, including exploration, transportation, refining, marketing and trading as well as in the manufacture of chemicals, fiber glass products, process and pollution control systems, venture capital programs and even cattle raising. Annual sales of the 3,000-employee company are approximately $550 million. The Kochs, including an older brother in show business in New York City, hold 80 per cent of the stock. They're all bachelors. The firm was founded by their father, Fred C. Koch, 45 years ago to build oil refineries. Mr. Koch, a Texas-born oil engineer of Dutch parents, shunned publicity and social affairs. It was not until after his death in November, 1967, that outsiders discovered he was perhaps the richest man in Kansas. Like his father, Charles attended Massachusetts Institute of Technology and received three engineering degrees. After working for oil and industrial consultant firms, he returned to Wichita in 1961 and began taking over parts of his father's operation. In 1966 he became head of the whole company. Under Charles Koch's leadership, the firm branched into new areas, launched an acquisition program, and more than tripled annual sales. In 1968 Charles changed the name of the firm from Rock Island Oil & Refining Co. to Koch Industries, Inc. 'We used to get calls in the middle of the night asking what time the next train leaves,' Charles explains. 'I began to suspect we didn't have a sharp corporate identity."

Bill Walsh has transferred to London with Mobil. His new job is manager of Strategic Planning with Mobil Europe, Inc., Mobil's management center for its European operations. Bill and Helen and their two boys and a girl live near Hyde Park. . . . **Ira Holtzman** has been appointed a sub-department head for information processing at MITRE. Ira was formerly director of the MITRE site at Scott Air Force Base, Ill., which is providing continued support in the design of an Integrated Management System for the command, control and management of airlift operation for the Military Airlift Command (MAC). Ira received his MBA from Wharton School in 1959. Immediately following his graduation, he joined MITRE on a full-time basis, having worked at the Bedford facility for a couple of summers while he was a student.

Roger Appel has been appointed sales manager of Graphic Data, Inc. Roger was formerly sales manager for Adage, Inc., and an applications engineer

for the Cambridge Thermionics Corporation. . . . That's all until the Ides of March. —**Frederick L. Morefield,** Secretary Tiirasaarentie 17, Helsinki 20, Finland

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A letter arrived from **Dale Dukes** telling us that he "just moved to Dallas in July to become sales manager of Self-Organizing Systems, manufacturers of reed relays. I am now making frequent visits to major U.S. cities and would enjoy seeing or hearing from old friends." . . . **James French** is still working at the Jet Propulsion Laboratory working on the Mariner Mars 1971 project. Here on earth, Jim reports that their son, James Ross, 3d, has just passed his first birthday. . . . **Robert Fulks** has just recently been appointed a vice president of General Radio Company, where he has been chief engineer. . . . **Gustave Fleischer** is a project engineer for the heavy construction contracting firm of Poirier and McLane. The Company specializes in construction of tunnels and similar projects. Gustave and his wife have two daughters, Cheryl 12 and Linda 9.

We received a brief note from **Richard Gottlieb,** post marked from Rome as a result of their recent move from Milan. He writes that he has "just started my activities as managing director of Control Data Italia, the Italian subsidiary of Control Data Corporation." . . . **Robert Kley** was recently appointed as design support and standard manager of R.C.A. Aerospace Systems Division in Burlington, Mass. Bob has been with R.C.A. in various capacities since receiving his M.S.E.E. from the University of Pennsylvania in 1962. He and his wife, the former Sally Jean Colby of Montpelier, Vt., and their two children are living in Lexington. . . . **Howard Salwen** is now working with Signatron Company in Lexington and living in Newton with his wife and their two children. . . . **Herbert Sobel** has just written a new book, *Introduction to Digital Computer Design,* which has been published recently by Addison-Wesley Publishing Company. He is currently assistant manager of Raytheon's Missile Systems Division's Digital Systems Laboratory in Bedford, Mass., and, at the same time, is currently serving as a lecturer at Northeastern University. . . . Among our letters this month was one from **Alan Marcovitz.** "This summer I became professor and chairman of the Electrical Engineering Department at Florida Atlantic University in Boca Raton, Fla. I am extremely busy with such tasks as recruiting faculty, establishing equipment needs, and devising a curriculum, not to mention getting ready for the fall quarter. Just to bring you up to date on my activities since graduation, I received a Ph.D. in electrical engineering in 1963 from Columbia University following completion of a master's program in Course VI-A. Then I spent the next seven years on the faculty of the Electrical Engineering Department at the University of Maryland during which time I coauthored two text books on computer technology, the second of which will be published later this year. Dianne and I now have two children, Susan 8 and David 6." . . . For the Walter Mittyes among us who have always wanted to be a writer, we offer the following letter from **Edwin Lee:** "Just retired from engineering to try and write a novel. It will be a fictionalized account of my experiences regarding the founding of MSI Data Corporation three and one-half years ago with two other partners. The company is engaged in the data communications market. Now have four and two-thirds children and will move from smog-ridden Claremont to Shangri-la, wherever it is, next summer."— **Michael E. Brose,** Secretary, 199 Sudbury Rd., Concord, Mass.; **Antonia D. Schuman,** Assistant Secretary, 22400 Napa St., Canoga Park, Calif.

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Tom Whitehead was written up in the April 1970 issue of *Fortune.* (page 70 for those of you who hoard back copies). Tom went from the Rand Corporation to the White House: he's a special assistant to President Nixon where, according to *Fortune,* he "coordinated formulation of the Administration's policy statement on domestic satellites and was instrumental in planning the new Office of Telecommunications Policy." Tom was interviewed by *Television Age* last year when he was studying the FCC; he said that "part of his task was to try to delineate more precisely the line between the policy-making and the quasi-judicial functions of the FCC and other agencies."

Howard Hornfeld dropped a line from Switzerland: "After spending a year in Santa Barbara to get a master's, I spent two years at the Army Chemical Center learning all about (and teaching some) chemical warfare stuff. During the indenture I gathered 6 weeks leave and hitchhiked around the Far East on Air Force planes. . . . After the Army I spent 3 years getting the hood at the University of Sussex in England, after which a 2½-year stay in Washington, Delaware, with Guess Which Co. (duPont) ensued. Early in my stay there I met Carolyn Geisler from (amongst other places) Mt. Holyoke and Arthur D. Little—and have since married her. Life in Delaware got on our nerves after a while, so we (both) quit duPont, took a Norwegian freighter to Oslo, and wandered around West and East Europe for about five months, finally (?) landing a job with Sandoz A.G. in Basle as a research chemist. Not yet finished wandering, however—going to spend a few weeks in middle/northern Sweden next month (August) before Junior is born in November—our first." . . . And as the Hornfelds head out, **Frank Tapparo** heads home: "Will complete a year's tour in Vietnam in November '70. I'm returning to Washington, D.C., for an assignment in the Office of the Army Chief of Staff. Mary (Sattan) and our two boys remained in Wheaton, Md., during my VN tour. Mary is a math analyst with NUS, Rockville, Md."

Richard Smith is a partner in the law firm of Wynne Jaffe & Tinsley in Dallas. He's been with the firm since 1965 and says "As you can imagine, I don't make a whole lot of use of the more technical portions of my M.I.T. education, but I am probably the fastest man in the firm with a slide rule. My wife Kay and I have two children, ages 3 and 0, the latter having been born November 12 (1970). I have been fooling around some in politics and am presently a Republican precinct chairman. I have also done some work for the local M.I.T Club and Alumni Association, which is quite active in Dallas."

The way the job market is going these days, I'm happier than usual to get all the news of promotions and new jobs. I haven't heard from anyone yet who's out of a job, but expect to any day. **Larry Elman** mentioned it in his note to me: "Like many others, I'm sure, I've found I can't quite decide if Nixon is having a War on Inflation or a War on the Economy. Either way, R&D is a victim. In 1970 I've had two more papers published in helicopter aeroelasticity, and followed this by having to make a job change. Am now doing computer analysis for an insurance company. That at least keeps me off the streets and eating—a statement a number of PhD's in this town cannot make."

David Perry graduated from the University of Maryland School of Medicine in June 1970 with the Jacob E. Finesinger Prize in Psychiatry. He's now on in internship at St. Agnes' Hospital in Baltimore and plans to do his residency in psychiatry. . . . **Joel Winett**'s second daughter was born on September 24; his older girl is now 3. Joel has been with Lincoln Labs since graduation. . . . **John Maier** is single, working for IBM's System Design & Development Division as the Assistant for Advanced Programs, and is "growing tired of bachelorhood." . . . **Salomon Seroussi** is also with IBM doing "something on computer netting and teleprocessing. My wife, Selma, and our two children, Michael (7) and Doreen (4) reside in Yorktown Hts., N.Y. All are welcome." . . . Major **Roger Hohman** has been with the U.S. Army Engineers since 1960, serving in a variety of assignments in Europe, the Far East, Africa, and the U.S. He received an M.S. in engineering at Arizona State University in 1968, is married and has three children. He is presently assigned to Engineer Command, Europe. . . . **Fred Smith** is now working for the Charles E. Smith Construction Co. Sorry, but I don't know where that is. . . . **Ray Gumb** is now teaching at Lafayette College in Easton, Pa.

Harry Hopfenberg is teaching chemical engineering at North Carolina State University in Raleigh; he was voted most popular teacher on campus by the student body. . . . **Mark Porter** has been appointed product development manager —industrial separations for the Scientific Systems Division of Amicon Corp. of Lexington. Mark was with AVCO's Applied Technology Division before joining

Amicon. He will assume prime responsibility for the development of the company's large scale ultrafiltration equipment. . . . **Harold Wolf** has been married since July 1962 to Charlotte Mesuse, a 1963 graduate of the New England Conservatory (voice). They have two children, Amy four and Philip two, and two dachshunds, Roo four and one-half and Snoopy three and one-half. Harold writes that he has had a leading role in "the development of techniques for operational use by the Weather Bureau of atmospheric remote-sensing data from NIMBUS satellites." He and his wife are both active in an adult group performing live theatre for children.

Ted Kraver is starting a business to produce pig skin heterografts for use by doctors on burn cases; he shipped out over 5,000 square feet of skin in six months. . . . **Mark Pratt** is sales manager —aromatics, for Enjay Chemical Co. in New York City. . . . **Dave Kalish** has moved to Atlanta where he is working with Lockheed-Georgia Co.

This summer we've run into **Bill Ross** and **Dave Aaker.** Chris found Bill at the Magazine Laundromat one night and brought him over for a drink. Bill is still making harpsichords in Boston; he's divorced now and is building a fantastic house in Maine (we've seen photographs but haven't yet had a chance to take a closer look). If any of you want a harpsichord, Bill will build one for you or sell you a do-it-yourself kit. Dave Aaker was in town last week for the American Marketing Association meeting; he had left his wife and two daughters back in California. Dave is an assistant professor at the Business School at Berkeley. **Hal Dodds** and his wife were also here in June; they came up for Alumni Day and brought their 14-month old daughter Laurel over to visit for a while.

Keep those cards, letters and bubble-gum cards with your pictures on them coming. Send them to—**Linda G. Sprague,** 10 Acorn St., Cambridge, Mass. 02139

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Emanuel G. Terezakis married the former Anneken Resch of Providence, R.I., and formerly of Drammen, Norway, last November. He works for Owens-Corning Fiberglas Corp. in Ashton, R.I.

Joel Karp co-authored a paper at the International Solid State Circuits Conference last February and will deliver a paper at an IEEE convention session on semiconductor memories in March.

Lieutenant **Willard Free** is pursuing a career in the Supply Corps of the U.S. Navy. He completed an M.S. in operations research at the Naval Postgraduate School, Monterey, Calif., last October. He is currently teaching in the Operations Analysis Department there and is working towards a Ph.D. His wife, Marlene, is head of the Home Economics Department of Monterey High School. They have a son, Daren Carlyle, age 3½.

Peter Goldstern is handling European marketing for Digital Equipment Corp.'s new 16-bit UNIBUS computer, the PDP-11. . . . **William H. Anderson** has been appointed chief resident in psychiatry at Mass. General Hospital.

Richard Sutton is now out of the army and employed on an N.I.H. fellowship in the Department of Radiology at the University of Missouri School of Medicine and expects to be there for four more years. . . . **Herbert Selesnick** was awarded a Ph.D. in political science at M.I.T. last June and is now a senior associate at Harbridge House, Inc., an international firm of management consultants headquartered in Boston. He provides consulting services to public agencies at all levels of government. His doctoral dissertation was "The Diffusion of Crisis Information: A Computer Simulation of Soviet Mass Media Exposure During the Cuban Missile Crisis and the Aftermath of President Kennedy's Assassination."

My family will be moving to Los Angeles in January, where I have accepted a position as president and chief executive officer of Portable Parking Structures International. This 2½ year old firm builds steel structures with precast concrete slab decks for locations that will ultimately have a better and higher use than parking. After it has earned a return and the next use is imminent, the structure can be completely dismantled and relocated on another site. I brought in a new investor group to take control of the privately held firm and intend to build and operate structures for the company's own account.—**Gerald L. Katell,** Secretary, 13751 S.E. 20th St., Bellevue, Wash. 98005

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Captain **Edward Arnn** was recently awarded the Air Force Commendation Medal for meritorious service as a project officer in the area of space defense systems. He and his wife JoAnn are living in Los Angeles. . . . **Howard Cedar** received both his M.D. and Ph.D. in biochemistry in 1970 from N.Y.U. He is now doing research in neurochemistry as a Fellow at the N.Y.C. Public Health Research Institute. Howard and his wife Zipora have a two-year-old son. . . . **Tom Charchut** is a research scientist with Technology Service Corp., in Santa Monica. His wife teaches kindergarten in the local schools. . . . **Ted Cruise** and his wife Sherry had their first child, Gregory Michael, in April of 1970.

James Flink and his wife Marcie are in Denmark until this summer, where Jim is a visiting professor at the Technical University of Denmark. He speaks Danish and is setting up a food technology department along the lines of M.I.T.'s. . . . **Herb Herrmann** is engaged in seafloor engineering research for the navy. His bachelorhood ended last December with his marriage to Marilyn Clunn, a school teacher from Douglass College. . . . After receiving his M.S. in E.E. from the University of Pennsylvania, **Mark Lappin** is now in his second year of law school at the same university. . . . **Bernard Morris** is working at Bell Labs in Allentown, Pa., having formerly been with the N.A.S.A. Electronics Research Center. . . . **David Morrison** was married last August to the former Cynthia Statkun (U. Mass '67). They are living in Albany where Dave works in the General Electric plastics department. . . . **Jon Orloff** is an analyst for Evans Products Co., in Portland. He and his wife raise dogs at their country home. . . . **Marlyn Pettit** married Maureen Kelly in Detroit last August. He is now managing Cimarron Corp., which operates dry cleaners and coin laundries.

Larry Rabiner, presently engaged in research at Bell Labs, was co-author of an article in the October, 1970, issue of *IEEE Spectrum* concerning synthetic voices for computers. . . . **William Roberts** and his wife Linda became the proud parents of William Woodruff, their first child, in July of last year. . . . **Anthony Robinson** in a second-year resident in psychiatry at the Boston University Medical Center. . . . **Daniel Saarela** was discharged from the Marines in February of 1970. He is presently a candidate for a master's degree in management information systems at the University of Minnesota. . . . Donald Silversmith reports the dismaying news that one of our classmates, **Arthur Joel Greenberg,** leaped to his death from the Golden Gate Bridge in July of 1970. The newspaper clippings indicate that Arthur had been under the treatment of a psychiatrist, and that the leap took place within minutes of a fake "suicide" on the same bridge being filmed for a Hollywood movie called "B.S. I Love You." Arthur's parents live in Memphis. . . . **Bruce Stevens** and his wife Gail are restoring, largely by themselves, an old house they purchased in Newtown, Pa. . . . **Carl Uhrmacher** is a senior research engineer for FMC Corporation in Baltimore. He is also attending night school at Johns Hopkins, plays bridge, and is a founding trustee of Columbia Jewish Congregation. . . . **Edward Wolcott** is in Denver working for Gats on electrochemical projects. . . . That's all for now. Let me hear from you.—**Ron Gilman,** Secretary, 5209 Peg Lane, Memphis, Tenn. 38117

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The Committee on M.I.T. Education has recently published its preliminary report. The report contains many comments on the way M.I.T. has done things and a number of suggestions for changes. I will not try to summarize the report in this column, but assume *Technology Review* will do so elsewhere this month or next. I will, however, encourage everyone to read the report or a summary and would like to print your comments on it. Just send them in (preferably brief) to me at the address below.

Peter Sexton is now a senior research member at Texas Instruments in Attleboro, Mass. . . . **Dave Rubin** reports that **Al Mallen** is now married and serving in the army in Thailand. . . . **Po Mar** has been elected vice president of Computer Techniques, Inc. . . . **Bill Huntington** was married in May. . . . **Tom Van Vleck** is the manager of planning and system analysis of the M.I.T. Information Processing Center. . . . **Mary Ellen Coffey** is working on her Ph.D. at Harvard's School of Public Health. . . . **Bill Thayer** passed the Massachusetts state architectural registration exams in June.

A few more advanced degrees have come in, though the next big surge should be in June. **Dave Cohn** received his Ph.D. from M.I.T. in June, 1970 and is now teaching information theory at Southern Methodist University in Dallas, Texas. . . . **James Sprinkle** completed his Ph.D. thesis in geology at Harvard last August and should be receiving his diploma about the time you read this. Jim moved to Denver in September to begin a one-year National Research Council-U.S. Geological Survey postdoctoral fellowship. He will be studying the evolution and stratigraphic usefulness of fossil echinoderms from the Rockies. . . . **John Freed** received his Ph.D. from Stanford in January 1971. John will be a postdoctoral Fellow in the Division of Immunology at the Stanford Medical Center. . . . **Charles Hurd** received his law degree from the University of Colorado in August, 1970.

Ron Mandle earns a hero medal by reporting on a number of classmates: **Ed Strauss** who is teaching 7th and 8th grade math at a private school in New York; **Barry Wessler,** who is working on a Ph.D. at the University of Utah; and **Dave Cohn** (see above). Ron reports that Barry had his first son last spring and **Phil Strause** his second.

Art Bushkin reports he was laid off as part of Lockheed's economy drive, has decided the state of the world is more important than computer science, and is now Western Regional Coordinator for the Movement for a New Congress. . . . **Ronald Wilensky** was married to the former Melanie Ann Gould in July, 1970. Ron is employed by Technology for Communications International in Sunnyvale, Calif. He will receive a Ph.D. in applied physics from Stanford early this year. . . . **Patric Dawe** has left the Philadelphia City Planning Commission and is working with David A. Crane and Associates on plans for Philadelphia's 1976 Bicentennial Celebration. . . . **Tom Maugh** has moved to Washington and is an Assistant Editor with *Chemical and Engineering News.* . . . Caroline and **Dave Kettner** returned to Concord, Mass., after a year's temporary assignment at SAMSO in San Bernardino, Calif. Dave continues at Lincoln Laboratory and Caroline is teaching sixth grade in Acton. . . . **Charles** (Chico) **Gholz** is now out of the army and working as a law clerk for Judge Giles S. Rich of the U.S. Court of Customs and Patent Appeals in Washington.

Sharon Ross reports she enjoyed the reunion and that the whole family is back in school: Bill working on a Master's in urban life at Georgia State University, Billy in first grade, and Sharon at Emory. Sharon says life is busy, but to call if you are in Atlanta. . . . **Mike Keehner** has been named a Baker Scholar for being in the top five per cent of the second-year students at the Harvard Business School. Mike was with the Quincy and Electric Boat Division of General Dynamics prior to entering the Business School. . . . **Tom Perrone** was released from active duty in the air force last August, and is now enrolled in a Master's program in statistics at Texas A&M University. . . . **Myron Weber** is working on a Ph.D. thesis in Industrial Relations at the University of Minnesota. We should have a lot more graduate degrees to report next summer. **Steve Lipner,** Secretary, 940 Belmont St., Watertown, Mass. 02172

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The big news of this month just has to be the election of **Ralph Davison** to the M.I.T. Corporation. Both he and Whitney Young of the National Urban League were elected to five-year terms. Ralph is the youngest person to be elected to the Corporation. He was President of the Graduate Student Council for 1969-70 and was an Ex-Officio member of the Corporation Joint Advisory Committee on Institute-Wide Affairs. Since receiving his Sc.D. in metallurgy and materials science, Ralph has been a research engineer at Ann Arbor, Mich., for the Climax Molybdenum Company, a subsidiary of American Metal Climax, Inc. Congrats, Ralph, and good luck!

And now to the degree mill and its finished products. **David Liroff** received his Ph.D. in Radio-TV-Film from Northwestern University in August and is now Assistant Professor of Radio-TV at Ohio University, Athens, Ohio. He and his wife Margy live on a farm with four cats and ten horses about fifteen minutes from campus. Margy received an M.A. in library science and now works at the Ohio University Library . . . **Bill Dietrich** got his Master of Business Administration and Juris Doctor degrees from Columbia last June and "after suffering through the New York bar review course" has begun work with Cresap, McCormick and Paget, a management consulting firm in New York. . . . **Richard Brady** writes: "After seeing n, where n is large, friends with Ph.D.'s in physics and no jobs, I took my M.S. in physics from the University of Maryland in August and promptly got a job teaching math at Woodrow Wilson Senior High in Washington, D.C." . . . **Charles Davis** graduated from Harvard Medical School and married Nancy Smith this past spring. He is presently interning in pediatrics at Yale-New Haven Hospital. . . . The National Science Foundation "bought" **Brian Schumacher** a Master's in mechanical engineering at the University of Michigan in 1968. Since then he has been working for a consulting outfit doing commercial R&D, first in Kansas City, and for the last year and a half in Cleveland—"the only city in the world with no women." He has turned 26 without being drafted and kills time on a Honda 4 and by sailing a Cat on Lake Erie. . . . **Ted Gull** finished his Ph.D. in astronomy in December at Cornell University. As of May 19, he is also the father of Michael Stephen.

Pete Catto is "happily married to the former Sharon F. Leichliter of Longmont, Colorado, as of June 28th." He is presently at Yale becoming "overqualified."

John Hopkins is still plugging away in his third year of medical school . . . **Martin Kaliski** hopes to get his Ph.D. in electrical engineering sometime in 1971. He's married to Judith Putnam, Wellesley '68. . . . **John Siegel** received a Ph.D. in aerospace and mechanical sciences from Princeton in November.

Then there are those still grinding away. **George Bourrie** is at Drexel University working on the Ph.D. in biomedical engineering. . . . **Pete Lobban** got hitched last December 28 to Nina Baller and expects his Ph.D. next September in biochemistry from Stanford. . . . **Tim Connelly** is working part-time on a Master's in cybernetic systems at San Jose State. The rest of his time is spent programming mini-computers at Lockheed. . . . **Ralph Schmitt** says: "adjusted my Ph.D. plans (Communication Theory) to change jobs from McDonnell Douglas to North American Rockwell. I'll study less and hopefully help make NASA's space shuttle work. Aerospace is hurting badly (Hardly a revelation!). Orange County, California, unemployment rate is 7.1%, swelled by aerospace and construction workers, 'temporarily displaced.' "

Stu Shapiro continues to work on his Ph.D. thesis in the Computer Sciences Department of the University of Wisconsin. A paper of his was accepted for publication in the *Communications of the ACM.* This summer he was best man at the wedding of **Richard Gray** and Lillian Weiner, who now live in Marblehead. Lillian is a Speech Pathologist, and Richard is at the USM Corporation attempting to automate the apparel industry.

Dave Penny has now started the first leg of his mission work in Moslem areas. He is attending the Bourguiba Institute of Languages, University of Tunis. . . . Chris and **Bob Wells** had a second daughter, Amy Elizabeth, on August 15. . . . **Guy Frindell** and his wife have moved into their new home in Columbia, Md., the completely new city being built from scratch halfway between Baltimore and Washington. . . . **Grant Moy** was married in September to Margaret Warner in Scranton, Pa. Peggy is a nurse at the National Institutes of Health in Bethesda, Md.

John Freeman sent along a note that **John Adger** is getting married in December. Adger is currently seeking oil in the

Libyan deserts. Freeman is leaving the Office of the Secretary of Defense after 2½ years there and is now working on the White House staff. . . . **Dave Ljungquist** has been promoted to equipment engineer—coordination at Southern New England Telephone. He joined the telephone company as a staff engineer and was a senior engineer at the time of his recent promotion. He and his wife live with their two children in Cheshire, Conn. . . . **J. N. Jackson** recently wrote a report for ARPA on a computer building design supersystem. . . . Certificates of Appreciation were again given to **Ken Browning** and **Stu Shapiro** by the M.I.T. Alumni Association for their efforts in the 1970 Alumni Fund. Your Class Secretary also received a certificate, this one being for having a column in each of the issues of the last volume of *Technology Review.* Thanks to you all for providing me the material for these columns. If my guess is correct, the number of letters is increasing with each month.

Page Smith sent a rather long note from which I cull the following. After leaving the service of Uncle Sam at Fort Knox, he returned to Columbia Business School in the fall of 1969. Previously, he worked for a while with Com-Share in Boston. There he met the new Mrs. Smith, Dariel. Page is now working for Trans World Airlines in their Functional Review Department. He and Dariel now call New York City home. . . . **Bob Klein** is back in Boston after a two year stint in the Public Health Service in Washington. He is part of a small consulting firm, Management Decision Systems, Inc., and specializes in on-line marketing models. . . . **Wayne Stevens** is a systems engineer for IBM who is transferring him from Cambridge to Hartford. His wife Penny and son Russell Morgan (14 months) will join him.

Also in the computer world is **Roy Poust** who is marketing manager for the education market of the PDP-10 line. . . . **Richard Cockerill** is an electronic engineer for the navy in Washington, D.C., where he's been for three years. At American University he spends his evenings working towards a Masters/Ph.D.

One of my old Urban Challenge colleagues, **Arlee Reno,** is a research associate at M.I.T. working on a project named "Transportation and Community Values." He consults on the side. . . . **Charles Peterson** is in his second year of the Peace Corps in Thailand working in leprosy control. He's due back in October. . . . After finishing two years in the Public Health Service, **Hank Goldman** worked in a political campaign for a while this past summer. He then returned to Washington, doing some volunteer work with Legal Aid and is now employed as a full-time consultant to the Office of Economic Opportunity evaluating consumer action and economic development programs. At nights, he works on his law degree.

Class Hero-of-the-Month is **Woody Sullivan** for sending me the most news about the most people ever! Actually, he sent me a copy of the Sigma Phi Epsilon Class of 1966 newsletter of last summer. If any of the other fraternities also put out such a blurb, why not send it along to me for inclusion in this column. I'd appreciate your culling out any "inside" stuff which wouldn't be comprehensible to those not in your house. The rest of the (slightly edited) column is due to Woody.

John Sowle and Elvin Calvin were married on July 19 in the country north of San Francisco. The celebration began with a supper at the bride's parents' ranch and ended with breakfast after a sunrise ceremony. Whoops, I hope the celebration didn't stop there! John has his M.A. in drama from Berkeley and met Elvin in one of the operas he directed.

Last word from **Karl Moller** is that he's a programmer at Smithsonian Astrophysical Observatory in Cambridge.

Chuck Tsiang is also at S.A.O. working on time and frequency standards, meanwhile sporting an impeccable goatee. . . . **Gerry Madea** is still in California and is the proud owner of a ski cabin in Squaw Valley. Everyone is invited! . . . **Ted Rhyne** is due out of the service soon. He plans to go back for a Masters. While serving Uncle Sam, he worked on the LORAN navigational system. . . . After getting his Ph.D. from Princeton in 1969, **Mike Romney** moved to St. Louis to become a research chemical engineer for Monsanto, although he talks of returning to Academia sometime. A daughter born in July, 1969, becomes his second child.

The May 25 issue of *Newsweek* had a writeup about **Tom Grover** and his doctorate research. He's measuring circulatory flow in humans via "hydrogen nuclei in the blood acting like tiny magnets."

Paul Godfrey got his M.D. from the University of Illinois and is now interning at Presbyterian-St. Luke's Hospital in Chicago. He married Maureen Kelly "who thinks Dublin is the capital of the world" in June, 1969. . . . **Dave Anderson** is working for Watkins-Johnson, a medium sized electronics outfit, in Palo Alto. He notes that after he applied his Harvard B School skills to his job, the W-J stock went from 63 to 14. . . . **Harry Moser** is an Industrial Liaison Officer at M.I.T. and has the "unfortunate" task of touring the Continent every year to take care of Olivetti, Fiat, ICL, etc. He says his 2½ year old son "counts to 10, does push-ups, etc." . . . **Joe Balcewicz** is working for R.C.A., where he taught a section of 6.05 to M.I.T. Coop students at R.C.A. He spends most of his time, though, "cuddling either Liz or the Mets"!?

Judi and **Frank McAninch** have gone westward, winding up in San Jose at the Hewlett-Packard place. **Roger Costa** also wound up there after getting married. **Steve Walther** is yet another H-P employee, but he works out of Palo Alto.

Rocky Lynch is finishing up his Ph.D. in math at Brandeis. He must have the Class's most unusual telephone number: 617-KISSTAD.

Howdy Morgan is working at the Draper Lab on Apollo-type navigation. Howdy has gone the hirsute route, drives a Mercedes, and lives in Auburndale. . . . Finally, **Woody Sullivan** himself is still plugging for the sheepskin in astronomy at the University of Maryland. He and Barbara toured England this summer for a month. She is working on a Master's at Maryland in human development. . . . Thanks, Woody!!

See you all at the Reunion in June. Cheers!—**Terry J. Vander Werff,** 2049 Manchester Drive, Fort Collins, Colo. 80521

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Why not give to the M.I.T. Alumni Fund? M.I.T. can use your support. . . . Kathy and **Ted Williams** are back on the East Coast again after a few years in California. Ted is working as a naval architect for a Manhattan based construction firm. . . . **Markus Zahn** received his doctorate from M.I.T. in August. He is presently an assistant professor in electrical engineering at University of Florida. He is hoping that his I-A classification will be changed to II-A. He and Linda should have a baby by the time this reaches print. . . . **Jim Williams** is an assistant professor of mechanical engineering. . . . **Stuart Schaffner** is working at Applied Data Research in Wakefield, Mass., and still enjoying life in Boston. . . . **Richard Stein** is in Fun City (New York) attempting to wrap up his Ph.D. He writes that it is time to put his energy into more vital work, and he is glad to see that M.I.T. is trying. . . . **Jon Sussman** is still with Itek Corp. in Lexington. His wife presented him with a baby girl in March, 1970. . . . **Dave Sanders** recently became the market manager of Hewlett-Packard's minicomputer division. He is in charge of marketing their computer products to data processing bureaus of all kinds.

The hectic boarding school life at Milton Academy has been keeping **Rick Dower** busy. In addition to teaching physics he has been coaching cross country and directing a production of Brecht's "Galileo". . . . **George Starkschall** is doing Ph.D. thesis research in the chemical physics program at Harvard. He is active in various musical activities in the Boston area; he is one of the founders of the Boston Summer Opera Theatre which last summer presented the Boston premiere of Benjamin Britten's "The Beggar's Opera." Any alumni in the Boston area are invited to join the organization for next summer's production.

John Robinson is a sales engineer at Teradyne Inc. of Boston. . . . **Stephen Metz** writes that he was swallowed by the navy and that he is assigned as Scientific Officer at U.S. Naval Research Lab, Washington, D.C. . . . **Joseph Levangie** is a senior business analyst with Avco

Systems. He is also teaching at Northeastern and enjoying bachelor life in Beantown. . . . First Lieutenant **Jerry Sevick** is forecasting weather at Altus AFB in Oklahoma and is working on his thesis for a M.S.E.E. from University of Minnesota. . . . **Nathan Curland** is finishing his Ph.D. work at University of Minnesota and has accepted a position as staff physicist with Micro-Bit, Burlington, Mass. . . . **John Rudy** is teaching a couple of evening computer courses at Fitchburg State College. He co-authored a paper to be presented at the 4th Conference on Applications of Simulation. . . . **Tom Ellis** is studying operations research at U.C.L.A. Business School. . . . **Robert Ruhl** was recently promoted to the position of Director of Engineering for Chase Brass and Copper Co. . . . **Robert Gerstle** is in his fourth year at N.Y.U. Medical School. . . . **Carl Doughty** received his S.M. in civil engineering from M.I.T. in 1968 and has since been teaching science and math in a hometown junior high school. He is also working part-time as a programmer for Northeastern Engineering and taking a few courses at University of Scranton. . . . **J. Erich Hespenheide** is planning to return to I.B.M., having completed his tour in the U.S. Army.—**Jim Swanson,** 774 Channing Ave., Palo Aito, Calif. 94301

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As we look out from our perch high above the scenic Charles River, Boston is covered with the first snowfall of the season. By the time you read this there will probably be a lot more—ugh. Think snow, but not here. I just returned from the National Electronics Conference in Chicago which was rather depressing. At least you didn't have to wait in line for anything. Exhibits were down 40% from the previous year. It makes you wonder about the state of the economy.

First Baby Contest

Surprisingly we have no weddings to report this month. Perhaps those who are left are all dedicated bachelors or maybe everyone is waiting until June. Regardless, in the December column we stated that Theressa Silver, daughter of Len ('66) and **Louise** (Lentin) **Silver** was the first baby born to a coed in our class. We based this statement on our own records. Of course, whenever you make such a bold statement you are sure to be proven wrong. Now the winner appears to be Michael Brothers, the two-year-old son of **Karen (Ellers)** and **Dennis Brothers** who really enjoys playing with Theressa Silver, according to Karen. Karen adds that she is working part time reading college math texts for a publishing company. Dennis is chief engineer for Logitron, Inc., a computer peripheral company he helped to start last year which is now a subsidiary of Bendix. He hopes to officially join the Class of '68 when he finishes his degree in a year or two as he is now a special student. Karen and Dennis have a small house in North Cambridge.

Selective Service Stories

Bob Haslam must certainly be putting his education to good use—he writes "Doing nothing for the U.S.A.F." . . . **Ken Hawes** is in the navy and is currently stationed at the Fleet Anti-Air War Training Center, Virginia Beach, Va., working on the development of a new shipboard electronic warfare system. Ken writes, "My big question is what to do for a living when I leave the navy. The answer will probably not be engineering." . . . **Frank Sheeman** has been promoted to Captain.

Finally **Tim Johnson** has refused military induction on the basis of conscientious objection to war and has begun two years alternative service at the Boston V.A. Hospital. He and his wife Nancy expect their first child in March.

We had a nice letter from **Gordon Logan** (First lieutenant U.S.A.F.), who is now stationed at Dyers A.F.B. and is living in Abilene, Texas. He is a C-130 co-pilot ("that's a four-engined turboprop trash-hauler for you civies"). Gordon also reports his November 27 marriage to a Southern Belle he met while in pilot training in Georgia. They have plenty of room, and welcome anyone to stop by for a visit.

Graduate School Stories

Pete Sorant is in graduate school in city planning at the University of North Carolina, Chapel Hill. His wife **Alexa (Mokede)** is an instructor there in the Biostatistics Department but really is a member of the computing group. . . . Dinah (Schiffer '69) and **Al Singer** are both enrolled at Columbia where Al is a third-year medical student and Dinah is a second-year biochem student. . . . **Gary Anderson** is a first-year student at Harvard Business School. . . . **Julius Gutman** writes that he is a third-year student at Tufts Medical School and is participating in an experimental program for a year at the Maine Medical Center in Portland.

Ken Rosenberg is a second-year student at the University of Pennsylvania Law School. He spent a year after graduation as a securities analyst for a Philadelphia Bank in Philadelphia and London.

Bob MacDonald is a special student at the Institute now and says "It's actually good to get back to some schooling, especially seeing a lot of people I haven't seen for over two years."

After spending two years working in Chicago for the Rock Island Railroad, **Andrew Jennings** and his wife Phyllis (Tufts '68) have returned to Boston where Andy is in Course I studying transportation. . . . **Doug Wilson** reports visiting **Don Zagier** in Switzerland last summer where they went mountain climbing on Mt. Blanc together. Don is working on his Ph.D. in topology in Bonn this year.

Richard Ehrenkranz is a third-year student at Downstate Medical Center in Brooklyn. His wife Ellen has completed a Master's in library science and is a librarian with the Brooklyn Public Library.

Richard Klass received an M.S. in aerospace engineering from U.S.C. in June 1970 and is back here as a first-year student at Harvard B School. . . . **Reynold Martin** has received a certificate as an engineer-in-training from the N.J. State Board of Professional Engineers and Land Surveyors.

We have also heard from **Rick Mazer** who is working in the Research Labs of Lockheed Missiles and Space Co. while in a part time Ph.D. program at Stanford. He hopes to start attending Stanford (Business School) full time as of next fall.

Ralph Rosenberg writes that he has spent the past year as a graduate student in biophysics at the University of Chicago on a U.S. Public Health Service Predoctoral Fellowship. . . . Last fall, **Sherman Hanna** started the M.B.A. program at Cornell University, after having worked there as a systems analyst. . . . **Gavin Clowe,** who graduated in September 1969, spent his final year here teaching high school math and science while working on his bachelor's thesis. He is now at Rutger's Graduate School in Computer Science. His wife, Susan, graduated from Wellesley in June 1969. The Clowes are expecting their first child in the spring. . . . **Michael Knudsen,** another computer scientist, is working for his Ph.D. in the field at Carnegie-Mellon University.

Salaried Ex-Students

Al Bernstein and **Ron Rosen** spent six weeks this last summer touring Canada's western parks and Alaska via the Alaskan Highway. Al then spent one month at the Dartmouth Outward Bound School and is now teaching chemistry and physics at the Storm Kew School near West Point. Ron is teaching math and physics at the Sterling School in Vermont and reports that he goes camping a lot with the boys from the school. . . . **Scott Marks** has been working as a computer/operations research consultant at Arthur D. Little since receiving an M.S. and B.S. in June 1969 and is enjoying the variety of work there. He is living "out" in Needham with his wife Pam, who works at the Institute, and their dog Kelley, an Irish Wolfhound.

Also at A.D.L. is **Robert Tinkelman** who was able to get a 2A for his efforts. He was married on June 7, 1969 and took his orals in math at M.I.T. in the fall of 1970, hoping to return full time either when he turns 26 or "Nixon ends the war," whichever happens first.

Tom Wilson is President of High Performance Plastics, Inc. which makes whitewater kayaks, canoes, chemical tanks, and pollution control equipment. His wife, Elsie (Crowley) is back at M.I.T. with the class of '73(?). . . . "After being a bum for many months," **Jerry Sabath** who was formerly with the old NASA/ERC is back at the same place, now Department of Transportation—Transportation Systems Center working on computer display hardware and his master's degree. . . . Also in Kendall Square, **Lenny Schrank** has started a software

development and consulting firm called Dynamics Associates. **Robert Anthonyson,** who received an M.B.A. from Stanford is also working in the firm.

I recently finished a term project for a statistics course in which I studied the number of donors giving to the M.I.T. Alumni Fund from recent classes. This study showed that the percent giving was strongly correlated with the logarithm of the years since graduation, at least for the first 10 years. It also showed that even when this and other growth factors are taken into account, the Classes of '67-'70 have had at least 8% more donors since they have graduated than have almost all classes in the past. I'm glad that we're putting our money where our mouths are and showing that we have faith in the old school. Maybe we can set a new record this year. Also my efforts to reform the election procedures of the Alumni Association seem to be yielding results. I am pretty sure that next year's election of alumni to the M.I.T. Corporation will be a real election. We've used up our backlog of material now so please write if you want to have something to read here. We'd like to know what you're doing, how you're getting along with the draft, etc. See you next month.—**Gail** and **Mike Marcus,** Secretaries, Eastgate Apt. 16A, 60 Wadsworth St., Cambridge, Mass. 02142

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Since this is the time of year when we send Valentine greetings to our loved ones, I thought it would be appropriate to begin this month's column with the marriages which have come to my attention in the past couple of weeks.

Steven J. Pecsenye married the former Miss Sylvia Wedul of Winona, Minn., on October 25, 1970. Steve is continuing in the M.A./Ph.D. program in ethics and society at the University of Chicago Divinity School. . . . **Wendell G. Iverson** exchanged wedding vows with the former Miss Pamela LiFrench two days after graduation in June of 1969. They traveled slowly across the United States visiting friends and relatives before boarding a ship in San Francisco for Australia. Pam is currently teaching hearing-impaired children while Wendell is working in protein chemistry under Dr. Pehr Edman in Melbourne. . . . **Thomas Najarian** reports that he and his wife Sina were married on September 5, 1970.

Edward Gruhl writes that since graduation he has married the former Miss Mary Curran of Boston University and has started an operations research job at Delco Electronics Division of General Motors. Ed is also enrolled in the M.B.A. night school program at the University of Wisconsin-Milwaukee. He and Mary have bought a St. Bernard puppy which is now six months old and weighs over 100 pounds. . . . **Tom Thomas** married the former Miss Barbara Killian on August 22, 1970. Tom entered the University of Missouri Law School in September. . . . **Jeffrey Lepes** was married on August 3, 1969, to Miss Elayne Grodberg, a 1969 graduate of Boston University. Before entering the graduate school in civil engineering at Carnegie-Mellon University in Pittsburgh, Jeff spent a year working for Metcalf & Eddy, Inc. of Boston. . . . **Henry G. Baker, Jr.,** was married on September 26, 1970, to the former Miss Carolyn Bowles, a 1969 graduate of Simmons College.

Among our classmates whose marriages have previously appeared in this column, I have the following news. . . . Al ('68) and **Dinah Singer** are both enrolled at Columbia University where Al is a third-year medical student and Dinah (Schiffer) is a second-year bio-chemistry student. . . . **Marc Davis** has begun his second year of graduate study at Princeton University in physics. His wife, Paula, has entered a doctoral program in physiological psychology at Rutgers University.

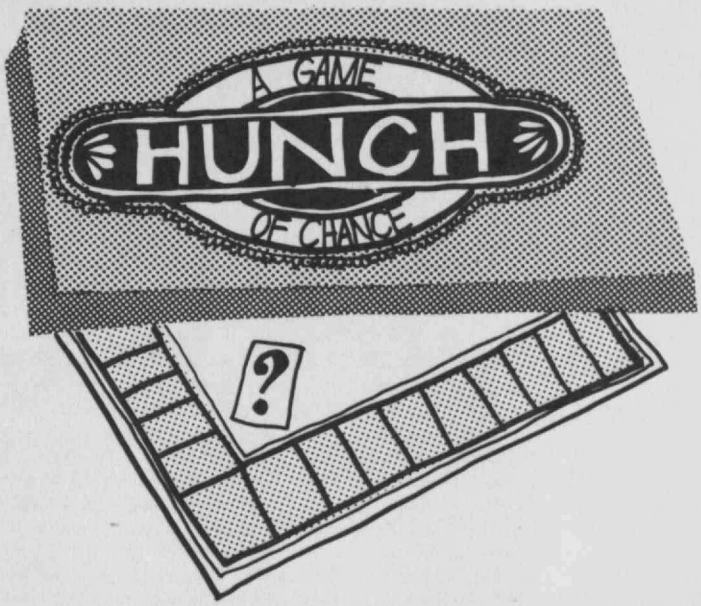
Mark A. Wuonola writes that he was amused to read in this column that he had received his Ph.D. from Harvard University. Apparently my information source—Harvard itself—was incorrect, and I would like this opportunity to straighten the record. Mark received his A.M. in chemistry from Harvard in June of 1970. At present, he is a candidate for the Ph.D. degree while working on a total synthesis of the alkaloid longistrobine under the direction of Professor R. B. Woodward ('36). Mark adds that several more years of work is anticipated.

Among other notes I have received the following: **Sara Clope** lived in England after graduation for a year teaching math and social studies in a secondary school. She is presently working towards her M.S. in Exceptional Education (language and learning disabilities) at the University of Wisconsin-Milwaukee.

Alan Davis is in his second year of study for his Ph.D. in computer science at the University of Utah. While working as a T.A. in a logic course, Alan is awaiting the snow so that he can take his skis "out of mothballs." He is also employed at Park City, Utah, as a ski instructor. . . . **J. C. Willing** was awarded a Marshall Scholarship in 1969. These awards, numbering about 24 each year, enable American students to study for degrees at one of 44 universities in England, Scotland, Wales, or Northern Ireland. Funded by the British Government, each scholarship has a value of $6,000 spread over a two-year period. This sum covers fares to and from Great Britain, tuition fees, and living allowance. . . . **James W. Rymarczyk** is currently employed in Cambridge by IBM SDD. Jim adds that he is working with **David Kelleher** in the field of future systems architecture. . . . **Glenn A. Martz** has recently completed a job with an architect as project designer for a one million dollar townhouse project in Boise, Idaho. Glenn is currently engaged in his own business of helping farmers to restore their barns by re-roofing and re-siding them in exchange for the old mossy wood which he sells for interior paneling. Glenn adds that he has volunteered much time to the Community Action League and has employed people through this non-profit organization. . . . Drop me a line when you get the chance.—**Richard J. Moen,** Secretary-Treasurer, 412 Hastings Hall, Cambridge, Mass. 02138

The $250,000 Hunch Player

It's a shame so many investors with sizable portfolios still make buy/sell decisions "by guess and by golly."



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